

Integrating **Climate Change Adaptation** into **Agriculture Sector Planning** in Nepal

A Training Manual for Agricultural Officers and Planners



Government of Nepal
Ministry of Agriculture and Livestock Development
Food Security and Food Technology Division
Singhadurbar

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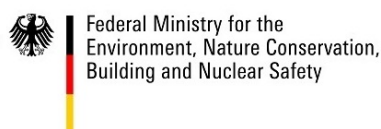
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Foreword

Climate Change presents overwhelming challenges. Nepal is witnessing increasing incidence of climate change related natural disasters, which have everely affected the agriculture sector and the livelihoods of the farmers. The agriculture sector policy and agriculture development strategy of Nepal strongly urge to increase productivity and promote natural resources to utilize them in the interest of farmers. With the observed and likely climate change impacts, it is urgent that the agriculture sector identifies clear needs for climate adaptation and investment to address climate risks to secure future livelihoods of farmers.

At the same time, there is a greater need for knowledge, understanding and capacity of government officials to reduce climate vulnerability and facilitate integration of climate change adaptation in a coherent manner through regular development planning processes. This training manual is timely. The training manual seeks to support agriculture sector planners, policy makers, extension workers and other concerned people to enhance their practical understanding with suggested tools and methods to integrate climate change adaptation into their regular plans. I believe this training manual will provide step by step guidance to government staff to facilitate integration of adaptation concerns into their regular plans which ultimately help build adaptive capacity and resilience in the agriculture sector. I am confident that farmers will be better served by government staff who apply what they learn through this training manual and that it will help them identify and prioritize climate change adaptation programmes.

This training manual has benefited from the pilot training conducted in all seven provinces under the leadership of MoALD. I would like to extend my sincere thanks to the government offices in the respective provinces for their cooperation and commitment. I extend my sincere appreciation to UNDP and FAO for their technical assistance and to the German Government for their generous financial contribution. I am grateful to the project team and partner organizations for their hard work for timely completion of project activities and production of this valuable output. I would also like to thank all the professionals who have been involved for their meticulous work in writing this training manual and bringing it to completion.

I encourage government staff, particularly those working under the MoALD, to read this training manual carefully along with the separate handbook to improve their knowledge and capacity to ensure agriculture development programmes are gender-responsive, use climate information and contribute to national climate change targets agreed under the Paris Agreement and the Sustainable Development Goals.



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Acronyms

AR5	Fifth Assessment Report
CCA	Climate Change Adaptation
CCVRA	Climate Change Vulnerability and Risk Assessment
GESI	Gender Equality and Social Inclusion
IPCC	Intergovernmental Panel on Climate Change
LAPA	Local Adaptation Plan of Action
LDRMP	Local Disaster Risk Management Plan
MoF	Ministry of Finance
MoPE	Ministry of Population and Environment
NAPA	National Adaptation Programme of Action
NCVST	Nepal Climate Vulnerability Study Team
NPC	National Planning Commission
UNFCCC	United Nations Framework Convention on Climate Change
VRA	Vulnerability and Risk Assessment

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Overview of the Manual

About this Manual

Various adaptation techniques and strategies are practiced by people, government and development institutions to mitigate climate change risks. Several such efforts are done without fully understanding climate change vulnerabilities, risks and impacts. This poor understanding often leads to failure in selecting adaptation techniques, which results in poor delivery and impact. Integrating climate change adaptation actions into government plans, policies and practices is poorly done. One underlying reason is inadequate knowledge of extension workers and planners on climate change, vulnerability assessment, selection of adaptation options, integration of climate action into local development plans and monitoring and evaluation of adaptation actions. Improving capacity is imperative. To do this, a first level of qualified people need to be developed so they can be deployed for training a larger number of people responsible for government planning at local, provincial and federal levels. Therefore, production of a training-of-trainers manual was considered essential.

UNDP and FAO, in coordination with Government of Nepal, implemented an Integrating Agriculture into National Adaptation Planning (NAP-Ag) Project between 2016 and 2018 with support from the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of the Federal Republic of Germany via the International Climate Initiative. This effort is part of the overall National Adaptation Plan (NAP) process aimed to fulfill Nepal's commitment to the United Nations Framework Convention on Climate Change (UNFCCC). The NAP-Ag project contributed to the Agriculture and Food Security (Nutrition) theme. The NAP-Ag project aimed at:

- (i) Developing an integrated roadmap for the NAP and addressing sector priorities aligned to Nepal's Agriculture Development Strategy.
- (ii) Supporting integration of adaptation needs in sectoral policy and programme development while improving evidence-based results for NAPs by developing a robust monitoring and evaluation framework.
- (iii) Strengthening technical capacities and institutions.
- (iv) Promoting advocacy and knowledge sharing through exchange of lessons learned.

Some modules, tools and methods in this manual have been tested in training events conducted at the provincial level. Feedback obtained by the organizers, resource persons and trainees has been incorporated.

Goal of the Manual

This training-of-trainers manual presents a five-day training course on the fundamentals of climate change and agriculture and tools for vulnerability and risk assessment and identification and prioritization of adaptation options. The manual aims to guide trainers and facilitators in using tools and techniques to train learners on various climate change topics and enhance their skill in conducting exercises. The aim is to make users capable of conducting training for government extension workers, mid-level government officials and planners engaged in subnational and local development planning, mid-level NGO practitioners and similar professionals.

Trainees will obtain knowledge and skills to support national, provincial and local governments to integrate climate change adaptation options into agriculture sector plans. After this training, participants will have:

- (i) Improved understanding on basics of climate change issues common in climate change discourses.
- (ii) Enhanced skills in conducting vulnerability assessments at local or subnational level.
- (iii) Upgraded capacity in identifying and prioritising agriculture sector adaptation options and integrating them into plans, programmes and policies.
- (iv) Skills to monitor the program at implementation level and document and disseminate findings for wider impact.

The handbook on Integrating Climate Change Adaptation into Agriculture Sector Planning in Nepal is meant to be used as the main source of materials for trainers and facilitators and as a source of readings for participants. The handbook provides detail on the topics and issues covered in the modules and sessions. In the session notes in each module, you will see references to the relevant section in the handbook.

Outline of the Manual

The manual follows the Least Developed Countries Expert Group guidelines to make it consistent with other government documents, including the roadmap for integration of climate change adaptation into local plans. The manual incorporates tools developed during the NAP-Ag project and from other organizations to make sure the sessions are customized to country needs and priorities. The manual consists of five modules, each with one or more sessions devoted to specific topics.

Instructions to Users

As the lead facilitator or master trainer, keep in mind the main objective of the training. What do you want the participants to have gained by the end of the training course? What change in knowledge should they demonstrate? Also keep in mind these points:

- Be ready to spend more time than initially planned on main topics if it is clear the group needs additional time to work through ideas or practical tasks. It is better to do a few things well rather than to speed through the entire curriculum and risk losing the group's concentration.
- Be flexible and spend time to discuss issues important to the group, even if not initially planned. You should, however, not lose sight of the final goal.
- And finally, enjoy the training and the participants, and embrace the opportunity to learn from the experience.

Guiding Principles for Facilitators

It is up to the course trainers and facilitators to make use of those guidelines and materials in the handbook that best suit the proposed course.

- Easily understood tasks should be addressed at the beginning of the training course.
- Broad concepts and technical terms applicable throughout the course should be introduced at an early stage, and complemented by supplementary materials where necessary.
- Concepts or skills likely to be frequently used should be addressed in the course content.
- Difficult tasks that involve complex elements and concepts should be introduced in an incremental fashion.

Exercise Tools

- **Brainstorming:** is generally a first step to generate interest and involvement. The trainer facilitates sharing ideas and asks learners to suspend evaluation or judgement. Ideas can be discussed later for practical consideration.
- **Interactive talks:** Encourage participants to be active and analytical in their learning approach.
- **Illustrative talks:** These are lectures supplemented by illustration and audio-visual aids. Presentation of success stories and case studies is also a useful method.
- **Group discussions:** This method is an effective instrument for participatory learning, whereby the trainer acts as a group adviser, facilitator and mentor.
- **Panel discussions:** This is one way to promote participatory learning. Here the role of the trainer is limited to coordinating and moderating the discussion, while the participants are the panelists and act as catalyst agents of the learning process.
- **Role playing:** This is one of the most effective training methods of participatory learning where participants put into action their new skills. A scenario is created whereby individual participants are assigned roles which they enact to demonstrate the skills learnt.
- **Workshop methods:** Participants are arranged into several groups, considering their interests. Identified by the leadership qualities demonstrated during interactions, each group gets a spokesperson to coordinate discussions and present decisions arrived at during the exercise. Each group is assigned a discussion theme relating to the topic being covered during the training session.
- **Classroom exercises:** These supplement the knowledge inputs provided through lectures and topics presented during the training session. Examples include developing a plan of action for a training programme.
- **Field exercises:** Participants go to the field and interact and learn from farmers and other stakeholders.

Other Important Considerations

- Ensure a good learning environment is created in advance.
- Focus the subject on the current needs and problems.
- Use a variety of participatory training techniques rooted in the participants' own knowledge and experience.
- Work in small groups when reflecting on activities.
- Ensure flexibility, allowing for adaptation to training activities as they progress.

Before the event: Agree on some ground rules. Set out and agree with the learners the way facilitators and participants relate to each other, how the training event will operate, and what is acceptable behaviour. Consider these points:

- Clarify the programme objectives and agenda. This is a two-way process. Facilitators come with a programme designed to achieve the learning objectives, but the participants also arrive with their own expectations and preconceptions. Both parties need to agree on how these two views will come together as an event. Two strategies can help create a shared vision of the workshop:
 - Before the event, good communication with participants will identify the critical issues as seen from the local perspective and introduce participants to the training methodology.
 - At the beginning of the programme, encourage the participants to identify their expectations and align these with the planned programme.

During the event: facilitators use their expertise in the topic to structure the material.

- Each session should move towards the learning objectives. The progression should follow a logical structure. The time spent on each topic is a matter of judgement by the facilitator and should be continuously checked to ensure clarity, relevance and interest. The facilitator should plan short feedback sessions throughout the training.
- The facilitator must ensure the process encourages participants to use as many of their senses as possible to maximise their learning. Research in educational psychology shows we remember 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we see and hear together, 80% of what we say, and 90% of what we say while we do it.

After the event: consolidation is important. Always go back over the main ideas and areas of learning covered. When the training is spread over several days or sessions, consolidate new learning with that already learned and lead into the next stage of the process.

- Revisit the expectations set on the first day and have a discussion about whether the participants expectations are met or not.
- Feedback should occur throughout the learning, but the closing session is where the most systematic exchange of feedback between the facilitator and learners should take place. This exchange is vital, as it provides both the facilitator and the **learners with a clear understanding of** how the contents of the event were perceived.
- It is essential to emphasize the importance of providing adequate time in the programme for evaluation. Too often, it is tacked on to the end of a session when everybody is thinking about finishing, so they do not take it seriously.

Tips for Trainers

Your participants are government agriculture extension workers and they deserve the respect of their position, experience and expertise.

- Be warm, friendly, and enthusiastic. If you enjoy yourself, the participants will too.
- Learn the names of participants or have them make name badges. Use individuals' names; not just to ask questions, but if you refer to a point made by a participant, acknowledge it by naming the person.
- It is your job to create an atmosphere where people are willing and able to learn. Never set yourself up as the boss or show an "I know everything attitude".
- Make sure participants know each other and feel comfortable in each other's company.
- Be genuinely interested in what your participants have to say. If you need clarification or more explanation, ask for it gently and with a smile. Remember, you are not an examiner.
- Listen to what participants say. Do not stop listening part way through to formulate your response. Nobody minds if you think for a few moments before answering. It is a compliment to the participant.
- Make frequent eye contact but do not stare, which intimidates participants. Make eye contact with all the participants.
- When you move around the room, stand beside people you wish to speak to not in front as this may be seen as aggressive, especially if you lean over a desk or table.
- Speak clearly and not too fast, but with expression. A monotone will put your participants to sleep.
- Use the level of language your participants need. This is not the time to prove how clever you are. Simple language does not mean simple concepts.
- Make sure your voice is loud enough for all participants to hear. Humility is not judged by a soft voice.
- Move for a reason, to make a point, to talk to a particular group, to check if people need your help.
- Visit the venue before the training event. This will allow you to make the best use of space.

A trainer must be:

T - Time-bound

R - Realistic & Ready

A - Active & Attentive

I - Ideal, Inspiring & Informative

N - Needs-based

E - Enthusiastic

R - Responsive

Introduction to the Modules

0. Setting, Participant Introduction and Expectation Collection

This module introduces techniques to ensure participants understand the training program modules and sessions and get to know each other. This Module also presents tools and techniques used in the pretraining assessment of participant understanding and expectations and will be used for evaluation.

1. Laying the Groundwork for Adaptation Planning and Implementation

This module is about the process followed in laying the groundwork and addressing existing gaps. Following a brief description of how NAP evolved, the module informs participants of the process followed by NAP-Agriculture project in Nepal. It highlights how different working groups were formed and what the group on Agriculture and Food Security aimed for and summarizes the results of the stocktaking.

2. Preparing for Integration of Adaptation into the Agriculture Sector

The module is an introduction to the main concepts and terminology used in climate change science and discourses. The module introduces causes of climate change, how agriculture is vulnerable to climate change, how vulnerability analysis is conducted using multicriteria and economic analysis, what adaptation techniques are viable and how they can be prioritised on the basis of multiple social, economic and ecological criteria.

3. Implementing Adaptation in the Agriculture Sector

This module takes participants through the strategies used to integrate prioritised adaptation options in the planning cycle. It covers mainstreaming climate change adaptation actions into agriculture with a focus on ADS planning and budgeting, including links with databases such as the Line Ministry Budgetary Information System and Subnational Treasury Regulatory Application (SUTRA).

4. Monitoring, Review, Reporting and Communication

This module presents the basic concepts of M&E, the M&E framework and its use in evidence-based planning, awareness creation and capacity building. It also makes learners familiar with the indicators used in M&E, impact assessment tools and methods, institutional arrangements and data collection, documentation and result sharing techniques.

5. Training Evaluation, Feedback and Closing

This is a nontechnical module devoted to methods and tools used in evaluation of training, techniques to summarize the program, and closing the program.

Module 0: Introduction, Expectations and Norm Setting

Module Overview

When government is involved, a formal opening is common practice in Nepal. Knowing each other makes the learning environment more conducive and facilitates discussion and group work. Making expectations explicit and pretraining knowledge assessment helps make sure training materials are not too difficult or too easy. It is also important to present the whole training programme so participants prepare themselves.

Module Aim

The Module has the following objectives:

- Present formal and informal methods of opening a training event.
- Make participants familiar with each other and create a positive learning environment.
- **Outline the program schedule in detail, including day-by-day activities.**
- Collect expectations about the training to customize the training sessions.
- Assess the level of understanding and skills of participants about the subject **matter**.

Learning Outcomes

At the end of the module, learners can:

- Formally and informally open a training program.
- Address other learners by name, know something about their fellow participants, and feel comfortable with each other.

Session I: Inauguration, Training Programme and Participant Introduction

Time:	90 minutes. Take a short tea break between inauguration and the rest of the sessions.
Methods:	PowerPoint presentations, interactive and participatory techniques, moderated discussions, question and answer sessions
Materials:	Computer, LCD projector, metacards, markers, masking tape
Objectives:	To make ToT participants familiar with opening techniques, methods of sharing training objectives and programme details.
Notes for Facilitators:	<ul style="list-style-type: none"> • Inauguration can be done according to the location, type of participants, and the presence of senior and junior level government officials. It could be formal or informal based on the context. • Welcome all the participants; introduce yourself and other trainers. • Describe overall content and objectives of the training. • Take time to introduce the training programme because it is the key to a successful event. • Ask participants to introduce themselves. • Make sure participants know each other and that they feel comfortable in each other's company. This will create a positive learning environment. • Use participatory methods and not only PowerPoint presentations or lectures.

Inaugurating Training

Depending on the time available, the venue and the type of participants, the facilitator may choose a formal or informal inauguration technique. For a formal inauguration, invite a senior government official or a government representative as the Chief Guest and have her/him light a candle or lamp, sow seeds of a crop or vegetables, water a plant or introduce a new piece of farm machinery. The Chief Guest can also introduce a new book or tools and technologies during the opening. In Nepal, the national anthem is played in the background while the inauguration is taking place. Following the opening ceremony, the Chief Guest is asked to say a few words about the importance of the training and her/his commitment to support the programme and the expected long-term goal of the training.

Sharing Training Programme and Objectives

Once the opening is over, the facilitator should share the objectives of the programme and present a day-to-day breakdown of the sessions using flip charts, metacards or PowerPoint. Printed and e-copies of the training schedule should be shared with each participant.

Getting to Know Each Other

This session suggests ways of introducing participants to one another. Other methods may be used, provided the participants enjoy themselves, gain some useful information about one another and remember one another in the future. Some methods for getting to know participants are:¹

¹ Accessed at <http://www.fao.org/3/ad499e/ad499e05.htm#TopOfPage>

Make the participants stand in two circles facing each other. Each circle moves clockwise when the music is played. When the music stops, each participant pairs with the one opposite her/him, asks the other's name, address and something about the groups they have known or belong to. Start the music again. When the music stops, participants form new pairs and ask each other the same questions.

It takes five to ten minutes to complete one round. Organize a maximum of three rounds. Ask the participants to sit down after two or three rounds. Participants are now invited to introduce anyone but themselves. Some people may be introduced more than once. Make sure all participants are introduced. It is good if the trainer joins the activity. If the trainer does not play, then at the end she or he must introduce him or herself. Joining the participants in the game establishes quick rapport between trainer and trainees.

Session II: Pretraining Assessment, Expectations and Setting Norms

Time:	90 minutes
Methods:	Questioning and learning wheel, facilitation questions, form filling
Materials:	Metacards, flip chart, markers
Objectives:	To assess the level of understanding of the training topics, assess expectations and set norms to be followed during the training.
Tips to Facilitator:	<ul style="list-style-type: none"> • Introduce the pretraining assessment form with objectives and ask learners to complete and return them. • Be cautious about asking too much about a participant's motivations and expectations because some people feel uncomfortable speaking in public. Metacards can be used to collect expectations making sure what a participant writes is confidential. Group learners according to their similarities and post on a wall. Ask for clarification if needed. These expectations are revisited during the final evaluation. • Discuss and set some standard behavioural norms to be followed throughout the training period (e.g. not interrupting someone while they are speaking).

Pretraining: Participant Knowledge and Skills Assessment

It helps to examine how much knowledge the training enhances which is done by making a before and after comparison. An evaluation wheel is one popular technique.² Training topics are written on the edge of a wheel drawn on a flip chart with scores from 1-10. Participants are asked to put a dot on the score that reflects their level of knowledge. The frequency is counted for each topic. Another technique is filling in a form where several questions are given. Often the same questions are asked both before and after so changes can be measured.

Participant Expectations

Participant expectations are recorded initially to see if they match with the training objectives and if the facilitator has enough materials to meet those expectations. The facilitator discusses expectations and makes adjustments in the course content, presentation, and schedule if necessary. Several expectation collection techniques are available. One method is described below.³

- Give two to three cards to each participant. The trainers must have cards prepared for each objective and topic to be covered.
- Ask participants to write their objective and expectations, one on each card. Give them time and ask them to write without consulting anyone. Ask them to be specific.
- Ask each participant to read their cards out loud and pin them on the board. Organize this according to the topics to be covered. Keep one column for cards which state objectives that will not be met during the workshop. Alternatively, collect the cards and pin them on the wall making sure similar points are grouped together.
- When all participants have pinned up their cards, trainers must place their own cards in key places to show which objectives will be met.
- It is important to point to the topics that participants want to learn about, but which may not be part of the workshop. Discuss how these topics might be addressed in the future.

² Accessed at <https://www.gtcs.org.uk/professional-standards/using-a-coaching-wheel.aspx>

³ Accessed at <http://www.fao.org/3/ad499e/ad499e05.htm#TopOfPage>

While it is a good idea to make changes to accommodate as many needs as possible, it is not a good idea to deviate too much from the original plan. The original plan has been developed on the basis of a training needs analysis with a lot of preparatory work. There are two disadvantages of too much deviation from the original plan: the preparatory work is wasted and then there is inadequate preparation for the new topics. Make major changes to the initial training plan only if it does not meet the main objectives.

Setting Norms

Before the training starts, set norms or ground rules that all the participants abide by. This is important because people from different sociocultural backgrounds and geographic regions have different attitudes towards learning, and different behavioural norms and values that should be respected. It is also important to set norms about punctuality, asking questions, group discussion, and avoidance of side talk, noise, and mobile phone use.

Example norms:

- Start and finish on time.
- Help each other when needed.
- Participate in discussions, everyone has a right to speak, no domination, give turns to those less active, encourage women participants to speak and put forth views.
- No cell phone use during sessions. Switch off phones or put them in silent or airplane mode.
- No side talk during presentations and discussions.
- Every question is a good question.

Module 1: Laying the Groundwork: Understanding NAP, Policy, Practices, and Capacity Gaps

Module Overview

This module lays the groundwork for planning, financing, implementation and monitoring climate change adaptation work in Nepal. Before an adaptation plan is initiated, understanding the basic concept of the National Adaptation Plan is imperative. It is also important to make participants familiar with the status and gaps in policies, initiatives, national capacities and knowledge about climate change adaptation before they start planning actions. More important is to have a good understanding about 'adaptation' since the training programme is about integration of adaptation actions into agriculture sector planning.

This module presents the National Adaptation Plan (NAP) and the NAP formulation process followed in Nepal. It also highlights major national policies and programmes and climate change projects implemented so far. Finally, the module summarizes gaps in knowledge, actions and national capacities.

Module Aim

The module has the following objectives:

- Introduce the evolution, rationale and intent of NAP at global and national levels.
- Improve understanding of the NAP formulation process and actions involved in the process.
- Share the results of the activities stocktaking, capacities, knowledge, and gaps in integrating climate change adaptation into the agriculture sector.
- Be familiar with the strategies to address gaps and weaknesses and their links with development priorities.

Learning Outcomes

At the end of this Module, participants can:

- Describe how NAP evolved and what its intent and rationale are at global and national levels.
- Explain the NAP formulation process and actions taken.
- Explain the activities, capacities, knowledge, and gaps in integrating climate change adaptation into the agriculture sector.
- Describe the strategies to address gaps and weaknesses and their links with development priorities.

Session I: Concept of Adaptation, NAP and Nepal's NAP Formulation Process

Time:	60 minutes
Methods:	PowerPoint presentations, question and answer, discussion, quizzes
Materials:	Handouts, projector, laptop, flipcharts, markers
Objectives:	To improve understanding about NAP and its importance, evolution and intended goal and to familiarize learners with the main issues considered and the process followed while developing the NAP in Nepal. Specifically, it presents facts about how working groups, technical taskforces and steering committees were formed. The session begins with the concept of adaptation and then moves to NAP.
Tips to Facilitator:	<p>Start off with general questions. How many have heard about NAP? What does it mean? What does adaptation mean? How do you distinguish between adaptation and resilience, or adaptation and mitigation? Have a quick discussion with participants. You can use a buzz group discussion where 2-3 individuals discuss and then agree on a common view.</p> <p>Give maximum time on adaptation because all other sections are about adaptation. Participants should have basic knowledge about adaptation to understand the other sessions and modules.</p> <p>Give a presentation on NAP and the NAP process (30 minutes).</p> <p>Do a 20-minute exercise followed by a 10-minute plenary discussion. Split the group in two and have one group discuss the difference between adaptation and mitigation and the other the difference between adaptation and development work. This is important because in later sections, participants often get confused with these terms. They should be able to distinguish between activities related to mitigation, adaptation and common development after this session.</p> <p>Be careful not to overload learners with information. This module is to assure a basic understanding about the NAP and associated processes and initiatives.</p>

Concept of Adaptation

This session focuses on ensuring a basic understanding of adaptation and the distinction between adaptation, mitigation and resilience. Be sure participants are clear about the meaning of each term before going on to the next session.

The IPCC defines adaptation as “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates, harms or exploits beneficial opportunities.” To enhance resilience and manage current and expected stresses to their livelihoods, people make alterations in their decision-making environments. Various adaptations are described in Box 1 and the major decisions made by UNFCCC in the evolution of the concept of climate change adaptation are presented in Figure 1 in the Handbook.

Adaptation is increasingly regarded as an inevitable part of the response to climate change. Societies have a long record of adapting to the impacts of weather and climate through a range of practices that include crop diversification, irrigation, water management and insurance. But climate change is posing novel risks often outside the normal range of experience. Adaptation to climate change takes place through adjustments to reduce vulnerability or enhance resilience in response to observed or expected changes in climate and associated weather events. Human and natural systems have a capacity to cope with adverse circumstances but, with continuing climate change, adaptation will be needed to maintain this capacity.

Adaptation involves reducing risk and vulnerability, seeking opportunities and building the capacity of the nation, municipalities, Gaunpalikas, the private sector, communities, individuals and natural systems to cope with climate impacts. Adaptation includes anticipatory or reactive actions. Adaptation requires adequate information on risks and vulnerabilities to identify needs and adaptation options to reduce risks and build capacity.

There has been well-established observation of human adaptation to climate change over the course of human history, however, many individuals and societies are now vulnerable to present-day climate risks, which may be exacerbated by future climate change.

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 1. Overview of National Adaptation Plan

- What is Adaptation?

Needs and Options of Agriculture Sector Adaptation

Adaptation needs arise when the anticipated risks or experienced impacts of climate change require action to ensure the safety of populations and the security of assets, including ecosystems and their services. Adaptation needs are the gap between what might happen as the climate changes and what we desire to happen. In the NAPA, needs were discussed in terms of major vulnerabilities and priority adaptation activities (a hazard-based approach), but more recently, the focus has been on tackling the underlying causes of vulnerability such as informational, capacity, financial, institutional and technological needs.

Approaches to selecting adaptation options continue to emphasize incremental change to reduce impacts while achieving cobenefits, but there is increasing evidence that transformative changes may be necessary. Local governments, NGOs and civil society organizations are the main actors who can accelerate bottom-up efforts of communities and households in planning and implementing their selected options.

Identifying adaptation needs from climate risks and vulnerabilities provides a foundation for selecting adaptation options. Over the years, several categories of options have been identified. Not all adaptation needs can be met and not all options will be possible. Farmers have a long record of adapting to the impacts of weather and climate through a range of practices that include crop diversification, irrigation, water management, and disaster risk management, but climate change is posing new risks.

Adaptation options include a range of actions that can be organized into three general categories: structural/physical, social, and institutional. The structural and physical options include options that are discreet, with clear outputs and outcomes. They include structural and engineering options, applying discreet technologies, using ecosystems and their services to serve adaptation needs, and the delivery of services from national to local level. Social options target specific vulnerabilities of disadvantaged groups, including targeting vulnerability reduction and social inequities.

Overview of NAP and NAP-Ag

Climate Change and Sustainable Development Goals

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 1

- Overview of National Adaptation Plan
- NAP and NAP-Agriculture
- Table 1. Common features of SDGs and NAP goals.

Climate change has implications for each of the 17 Sustainable Development Goals (SDGs). National Adaptation Plans (NAPs) are a means of SDG implementation. In the agricultural, livestock and forestry sectors, adaptation can contribute to sustainable food production systems as well as the development of resilient agricultural practices, and ultimately of SDG Goal 2 to achieve Zero Hunger. SDG Goal 13 on climate change explicitly highlights adaptation as a mechanism to combat climate change and its impacts, with targets to:

- Strengthen resilience and adaptive capacity to climate hazards and natural disasters.
- Integrate climate change measures into national policies, strategies and planning.
- Improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

Table M1.1. Sectors addressed in NDCs and their status.

Sector	Status
Agriculture, food and nutrition	Included under policies, strategies and frameworks, adaptation actions, and mitigation actions
Forests, biodiversity and ecosystems	Addressed throughout the NDC
Water	Addressed under policies, strategies and frameworks, and building climate resilience
Energy	Addressed under policies, strategies and frameworks mitigation actions, and Nepal's NDC
Infrastructure and urban areas	Mentioned under institutions and mitigation actions
Human Health	Not addressed
Tourism	Mentioned

Source: Alfthan, et al., 2018. Addressed = explicit strategies to address the issue; Included = issue is considered; Mentioned = issue mentioned but no defined considerations or strategies.

NAP Formulation Process in Nepal

See the following sections, figures and tables in the Handbook.

Chapter 1

- Figure 2. Nepal's NAP formulation.

Formation of Working Groups

See the following sections, figures and tables in the Handbook.

Chapter 1

- NAP Formulation Process in Nepal
- **Table 2.** Working groups and coordinating ministries providing input to NAP
- Table 3. NAP-Ag Project Steering Committee
- Table 4. NAP-Ag Project Technical Taskforce

The Ministry of Population and Development (MoPE) led the overall NAP formulation process. To expedite the process, seven thematic working groups and two cross-cutting theme working groups were formed, and nine line ministries took the lead in working groups. The working groups identified several experts in respective themes to produce the deliverables for the thematic areas.

Formation of Agriculture and Food Security Working Group

See the following sections, figures and tables in the Handbook.

Chapter 1

- Implementation of NAP-Ag
- Formation of Project Steering Committee
- Figure 1. The concept of adaptation over time.

Session II: National Initiatives and Capacities, Knowledge and Adaptation Gaps

Time:	120 minutes
Methods:	PowerPoint presentations, question and answer sessions, discussion, quizzes
Materials:	Training materials, LCD projector, laptop, flipcharts, markers
Objectives:	Improve understanding of policies and practices adopted by different organizations and the gaps in action, capacity and knowledge of stakeholders on climate change issues.
Tips to Facilitator:	Give a 30-minute presentation. You may start with questions. Do we think Nepal has adequate capacity to deal with climate change? What has the government done with respect to climate change adaptation? Split into two groups and have one group discuss gaps in capacity, knowledge and skill and the other discuss gaps in adaptation techniques adopted by different organizations (60 minutes). Run a plenary session after the group exercise (30 minutes). Invite questions from participants so additional ideas are added.

National Initiatives in Climate Change Adaptation

It is important for the participants to know about national initiatives and adaptation gaps so they realize what needs to be done regarding integration of adaptation options into their own plans and programmes. It is also important to have participants discuss the capacity of different levels of government, which means the capacity of participants and their institutions. This understanding will motivate participants to learn more about the methods and strategies to fill their knowledge and skill gaps.

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 1

- International Negotiations, Treaties and National Policies
- **Table 5.** National initiatives for change adaptation and mitigation.

Policy Initiatives in Response to Climate Change and Agriculture

Plans, policies, strategies, acts, regulations and institutional arrangements related to climate change in agriculture are in place. The plans and policies can be grouped as formulation, legally formalized and actively implemented adaptation, mitigation and productivity related plans and policies. Additional details are available in CIAT, World Bank, CCAFS and LIBIRD (2017).

See the following sections, figures and tables in the Handbook.

Chapter 1

- National Policy Initiatives
- **Figure 3.** National policies at different stages
- Figure 4. Institutions working for Climate Smart Agriculture in Nepal
- Figure 5. Financing opportunities for CSA in Nepal

Adaptation projects implemented and responsible institutions in the Government of Nepal and NGOs are implementing climate change initiatives in different parts of Nepal (Table M1-2).

Table M1-2. Projects on climate change.

Project	Key features
Pilot Program for Climate Resilience	<p>Program of the Climate Investment Funds, administered by the Multilateral Development Banks (in Nepal the Asian Development Bank, the International Finance Corporation and the World Bank) to support implementation of country-led programs and investment</p> <p>Demonstrate ways to integrate climate risk and resilience into core development planning.</p>
Building Resilience to Climate Hazards	<p>Transition Nepal’s hydro-meteorological services into a modern service-oriented system that will build resilience today and adaptive capacity for the future.</p> <p>Enhance government capacity to mitigate climate hazards by improving the accuracy and timeliness of weather and flood forecasts for disaster preparedness by the general population and warnings for climate vulnerable communities.</p> <p>Support agricultural management information system services to help farmers mitigate climate hazards.</p>
Nepal Climate Change Support Programme (NCCSP-I)	<p>The MoPE implemented the Nepal Climate Change Support Programme with funding from the UK Department for International Development and the European Union in 14 districts of mid and far west Nepal.</p> <p>Enhance the capacity of government, particularly the Ministry of Population and Environment and the Ministry of Federal Affairs and Local Development, NGOs, CBOs, the private sector and community institutions to implement Nepal’s Climate Change Policy (2011) and execute the most urgent and immediate adaptation actions to increase the resilience of climate vulnerable and poor people.</p>
NCCSP-I Transition Extension	<p>An important government-led climate adaptation and disaster risk reduction project in Nepal, with outcomes focusing on the poorest and most vulnerable communities.</p> <p>Support the implementation of climate-resilient development projects in 14 Palikas as identified by Palikas and improve resilience of existing infrastructure through provision for maintenance or rehabilitation,</p> <p>Develop and execute an approach for capacity building for climate-resilient development planning and implementation.</p> <p>Support MoFE in formulation of climate-resilient development strategies, frameworks and guidelines through documentation of learning and evidence.</p>

Capacities, Knowledge and Adaptation Gaps

Despite the commitment to national and international treaties, formulation of policies and on-the-ground action, several challenges and barriers continue to limit the ability of the country to adapt to climate change and build resilience.

See the following sections, figures and tables in the Handbook.

Chapter 1

- Institutional and Policy Gaps and Barriers
- Knowledge and Technological Gaps and Barriers
- Financial Gaps and Barriers
- Table 6. Institutional capacity required for managing climate risks and advancing adaptation.

Table M1-3. Capacity, knowledge and adaptation gaps.

Institutional barrier	
Limited institutional capacity	Limited human, financial, scientific and technical resources hindering effective management of natural resources and adaptation to climate risks and impacts. Low capacity and infrastructure in research in adaptation leading to limited information and knowledge products on climate change and adaptation options and poor decision-making.
Changing institutional structure and responsibilities within implementing institutions	Reduced government capacity to plan, implement and monitor measures to support communities in the wake of recent restructuring of government institutions at all levels. Slow transition process of government at all levels with little clarity on roles and responsibilities of actors. The restructuring period is an opportune time to mainstream climate change into local planning processes and plans.
Absence of well-coordinated and harmonised institutional mechanisms to coordinate and manage climate knowledge and adaptation practices	Lack of coordination and consultation among actors working on climate change issues has resulted in overlaps and disjointed efforts instead of synergy due to the project-based, top-down, resource dependent nature of climate change knowledge generation and management initiatives at national and local level.
Lack of institutional clarity, roles and responsibilities among government agencies	Governments, CSOs, the private sector and international institutions all have different roles to play but there has been a lack of coordination which leads to duplications and redundancies in programmes and project activities.
Knowledge and technological barriers	
Inadequate climate change knowledge and information at national and local level	Policy-makers and development agencies have limited scientific and local evidence that can demonstrate why climate change is an issue and where and how climate change is affecting local livelihoods.
Effective response to climate change is hindered by knowledge and technology gaps	Farmers have evolved innovative technologies and institutions to coproduce climate sensitive technologies on demand and thus build resilience of their communities but such practices are ignored, which makes the local practices ineffective and technologies inappropriate.
Mismatch between the demand for and supply of climate change knowledge at local level	Communities are looking for answers to their day-to-day problems, particularly how to deal with critical stress periods within their farming systems and livelihoods. Rural households want a composite of knowledge advisories and technological packages to address the concerns of loss of life due to extreme events, declining productivity, crop failure and additional burdens on farming due to pest and disease outbreaks, water scarcity, family health issues and depletion of resources. Despite their demands Nepalese farmers receive inadequate guidance and inputs from the agencies concerned. Agrometeorological information is not readily available and seasonal forecasts and market information are not used to inform people. This is partly because the number of manual stations and automatic surface observation systems are not adequate to generate reliable data for weather forecasts and projections.
Practical and applicable climate change knowledge and practices is the foremost priority	INGOs and NGOs are providing more practical knowledge of how to respond to climate change impacts as experienced in communities, which underscores the continuing relevance of generating fresh knowledge both on-the-ground and science-based, marrying the two, and consolidating, sharing and using such knowledge to better prepare communities for the changes already taking place.
Despite the huge demand for knowledge, the supply side of knowledge management is inadequate	Despite numerous operating knowledge centres and networks at national level, many are dysfunctional or have become inactive. The absence of learning and sharing mechanisms at national level disrupts information flow even among national institutions. Knowledge management at national level is further constrained by limited financial resources and support from both national government and international agencies.
Limited climate stations for monitoring change and poor maintenance	There are still a few climate stations in the country and there has been poor monitoring and maintenance leaving several stations functioning poorly and recording false data. The number of stations: precipitation stations (173), climate stations (72), agrometeorological stations (21), synoptic stations (9), aero-synoptic stations (7), hydrometric stations (154) and sediment stations (20).
Policy barriers	
Nominal Implementation of plans, policies, strategies	The ministry lacks the human resources and institutional arrangements for effective implementation of policies, plans, strategies and frameworks. There is a huge gap in institutional arrangements, capacity to implement and mechanisms for adaptation policies and programmes at local level.

Financial barriers	
Lack of financial resources	Financial resources are critical to facilitate planned adaptation as it demands massive financial resources in developing countries. The country governments have to rely on international support to meet the cost of adaptation which has to overcome the project-based approach. Unless resources are available, the chances of meaningful adaptation are remote.
Limited access to financial services and incentives to adopt climate-resilient practices	Adaptation and more sustainable practices can create costs and risks. Government subsidies are poorly targeted and normally focus on reducing the costs of inputs without accounting for potentially negative spillover effects. Government has a short supply of staff and financial resources to cover a wide geographic area and current services are often concentrated in accessible areas. Subsidies are given irrespective of economic wellbeing, causing poor cofinancing or matching funds.

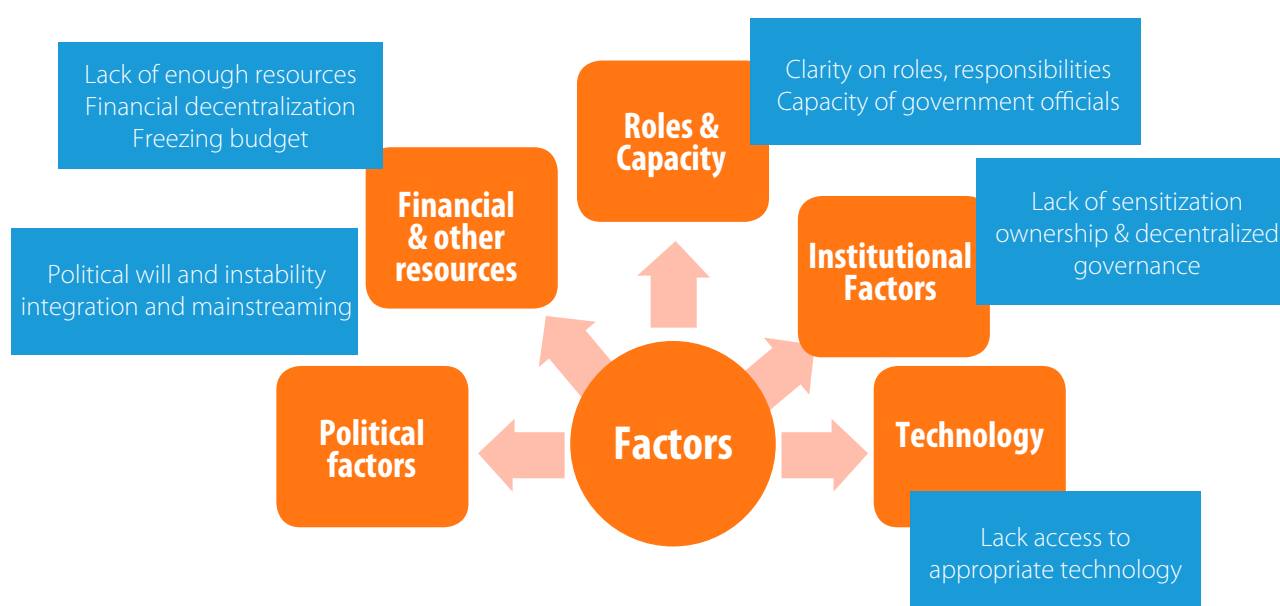


Figure M1-1. Barriers for effective implementation of plans, policies and strategies. Source: Maharjan and Maharjan, 2017.

The International Center for Tropical Agriculture (CIAT), World Bank, Climate Change, Agriculture and Food Security (CCAFS) and Local Initiatives for Biodiversity, Research and Development (LI-BIRD) jointly produced a country profile on climate smart agriculture in collaboration with the Ministry of Agricultural Development. They identified organizations working on adaptation, mitigation and productivity (Figure 4 in the Handbook) and public and private financing options for CSA initiatives at national and international levels (Figure 5 in the Handbook).

FAO has also identified several capacity gaps and needs for institutions in Nepal (Table 6 in the Handbook). The main capacity requirements are awareness raising and training on crop and livestock management, resource mobilization, income generation activities, introduction of new technologies and practices, enterprise development and improving market networking and capacity building, increasing access to credit, and disaster mitigation through ecological conservation, watershed management and biodiversity conservation.

It is of prime importance to facilitate knowledge sharing (i.e. lessons learned, experiences, best and failed practices, tools and skills) and action learning among researchers, practitioners, policy and decision-makers and local communities to support the adaptation process and capacity building critical for human resilience. Action learning is an approach for project implementation through a collaborative process of learning, research and critical reflection (Fisher & Jackson, 1999).

Table M1-10 summarizes how institutional roles have evolved in the past and how climate change issues have gradually been integrated into core work. It shows research has evolved from a 'work in isolation' and 'top-down' approach to joint, collaborative and needs-based approach and from a focus on high yielding varieties to climate-resilient technologies.

Table M1-4. Evolution of institutional roles in research and extension in Nepal. TABLE REDRAWN

Period	Research objectives	Approach	Institutional development
Before 1966	Research to address specific problems in isolation	Top-down approach providing specific interventions	Establishment of the Agriculture Office, experimental farms, and technical sectors
1966-1980	High yields; suitability for irrigated conditions; focus on the terai	Top-down approach to technological innovation; community-specific research	Establishment of agricultural research stations and farms; government institutions involved in research; limited collaboration with other institutions
1980-1996	High yields; disease resistance; rapid maturity; drought tolerance	Farmers' participation limited to adoption of improved varieties	Establishment of farming system research sites; establishment of NARC and focus on training and visit systems
1996-2006	High yields; disease and insect resistance; suitability for irrigated conditions; short duration and drought tolerance; focus on the mid-hills and rainfed areas	Focus on participatory technology development and Participatory Plant Breeding (PPB)	Involvement of NGOs, the private sector and civic groups in developing new technologies; decentralization of research; regular interactions with farmers; expansion of collaboration with international research institutions
2007 onwards	Participatory field demonstrations of climate-resilient technologies	Participatory learning by doing	Strengthening collaboration with district and local institutions for management of climate risks and adaptation to climate change

Note: compiled based on information from Basnyat (1995), FAO (2010d), NARC (2010a) and Chhetri et al. (2012)

Module 2: Preparation for Adaptation Planning, Integration & Implementation

Module Overview

During adaptation planning and integration, the major tasks are vulnerability and risk assessment and identification and prioritisation of adaptation options. Hence, prior to undertaking adaptation planning and integration, planners need to understand climate change and know about the tools and techniques to integrate climate change adaptation into local development plans and policies.

This module introduces participants to the basic vocabulary and concepts used in climate change discourse. The module explains why climate change occurs, how it contributes to global warming and how different sectors are affected. The module outlines methods and tools for vulnerability assessment and identification and prioritisation of adaptation options in planning processes. Some results from field level testing are also presented to help users link theory with practice.

This module is comprised of four sessions. The first session introduces climate change, its causes and trends.

The second session talks about climate change impacts on agriculture.

The third session presents methods and tools for vulnerability and risk assessment.

The fourth session is devoted to methods and tools for identification and prioritisation of adaptation options.

Module Aim

At the end of this module, participants will be able to:

- Explain the difference between weather, climate, climate system and climate change.
- Explain the causes of climate change and describe the major impacts on agriculture.
- Use vulnerability analysis tools, techniques and methods.
- See the relevance of climate change in adaptation planning and improved skills on climate change adaptation options for integration into plans, programs and policies.

Learning Outcomes

At the end of this session, participants will be able to:

- Explain key terms related to climate change.
- Describe climate change, its causes and main impacts on agriculture. Describe the concept of vulnerability and conduct vulnerability risk assessment and identification and prioritization of adaptation options.

Session I: Concepts, Causes and Trends

Time:	90 minutes
Methods:	PowerPoint presentations, question and answer, discussion, quizzes
Materials:	Training materials, LCD projector, laptop, flipcharts, markers
Objectives:	Explain the difference between weather, climate, weather system, climate change trend, causes and impacts of climate change on agriculture.
Notes to facilitator:	<p>Start with some questions. What do you know about weather and climate? What are natural drivers of climate change? How is human activity contributing to global warming?</p> <p>Give a short presentation using slides. Use videos wherever appropriate to help participants understand the issues.</p> <p>Conduct a group exercise on drivers and consequences of climate change on agriculture using participants' own experiences with farmers.</p> <p>During the exercise, in each group participants should divide into two groups: respondents and enumerators.</p> <p>Once the exercise is done, have the participants present their findings in a plenary.</p>

Weather, Climate and Climate System

The main concepts

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 2

- What is Climate Change?
- Natural Causes of Climate Change
- Anthropogenic Causes of Climate Change
- Figure 6. Our climate system showing interactions of different ecosystems and climatic activities
- Figure 7. A. Infrared radiation causing a greenhouse effect and B. interactions among the components of agriculture systems and Green House Gas emissions
- Greenhouse Gas (GHG) Emissions - Facts
- Global Trends and Projections of Climate Change
- Figure 9A
- Figure 9B
- Figure 10

Climate Change in Nepal

Nepal is highly vulnerable to climate change due to its poor economy and variation in topography, ecology and climate. The risk posed by climate change remains high to very high, but changes over time according to frequency and intensity of hazards. According to a Germanwatch Report, Nepal ranks fourth on the Global Climate Risk Index for 2017 (Figure 11 in the Handbook) with losses estimated at 1,910 million USD. The same report ranks Nepal 11th in terms of Global Climate Risk Index for the period between 1998–2017 (Eckstein et al., 2019). Nepal's contribution to global GHG emissions is only 0.027% (Figure 12 in the Handbook) but the impact the country bears is disproportionately high. The annual compound growth rate of CO₂ equivalent emissions for Nepal is lower than many other developing countries at minus 2% per annum (MoE, 2011) but there has been

about 1.8°C increase in temperature between 1975 to 2006, and the annual maximum temperature trend was significantly positive (0.056°C/yr) between 1971–2014 (MoPE, NAP 2017). The weather data from 1975 to 2009 shows that temperatures have increased by around 1.5°C, mostly during the dry season (December to March) particularly in the mountain region (Krishnamurthy et al., 2013).

Climate trends and projections also show threats are high, as presented later in this section. The synthesis report of the stocktaking for the NAP formulation process in Nepal prepared by MoPE in 2017 also highlights country context, climate change trends and disasters, exposure to the adverse impacts of climate change, climate change vulnerability, and main gaps.

See the following sections, figures and tables in the Handbook.

Chapter 2

- Box: Agricultural greenhouse gas emissions
- Figure 11. World map showing Global Climate Risk Index for 2017
- Figure 12. Nepal’s GHG emissions.

Additional materials

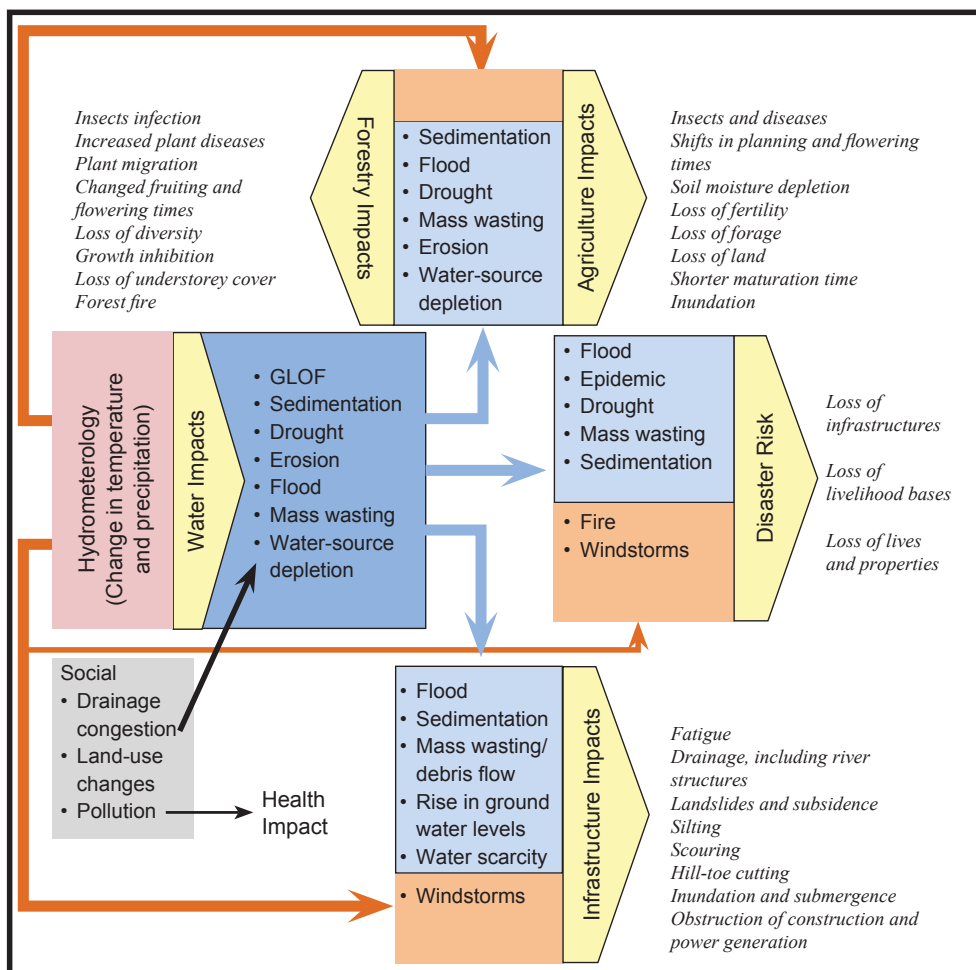


Figure M2-1. Climate impact interactions. NPC, 2011.

Climate Trends in Nepal

The Department of Hydrology and Meteorology published a report on Observed Climate Trend Analysis (1971–2014) in the Nepal Adaptation Plan Formulation Process. The report states that maximum temperature trends are higher than minimum temperature trends in all seasons. The significance test shows maximum temperature trends are more robust than minimum temperature and precipitation trends. The main findings of the report include:

- i) Significant positive trends are observed in annual and seasonal maximum temperature and minimum temperature shows a significantly positive trend only in monsoon season in all Nepal but there is no significant trend in precipitation in any one season.
- ii) The all Nepal annual maximum temperature trend is significantly positive (0.056°C/yr) and the annual minimum temperature trend is positive (0.002°C/yr) but it is not significant (see Figures 13 and 14 in the Handbook).

See the following sections, figures and tables in the Handbook:

Chapter 2

- Figure 13A & B. Spatial distribution of mean seasonal precipitation
- Figure 14. Projection of temperature change and precipitation change
- Climate Projection in Nepal

Additional materials

Table M2-1. Projection of temperature and precipitation change by physiographic region.

	RCP 4.5			RCP 8.5		
	2016-2045	2036-2065	2071-2100	2016-2045	2036-2065	2071-2100
Change in precipitation (%)						
High Mountain	2.57	9.46	12.55	7.96	14.36	25.1
Middle Mountain	1.66	7.59	10.3	6.29	12.42	21.66
Hill	21.4	70.18	9.86	5.81	11.16	22.55
Siwalik	1.56	7.44	9.85	5.84	11.08	21.36
Terai	2.11	7.25	10.16	5.44	10.56	22.71
Whole Nepal	2.1	7.9	10.7	6.4	12.1	23
Change in temperature (°C)						
	RCP 4.5			RCP 8.5		
High Mountain	0.95	1.36	1.79	1.09	1.86	3.61
Middle Mountain	0.89	1.27	1.66	1.04	1.76	3.44
Hill	0.9	1.26	1.69	1.06	1.8	3.56
Siwalik	0.94	1.29	1.72	1.1	1.87	3.66
Terai	0.93	1.29	1.73	1.11	1.87	3.69
Whole Nepal	0.92	1.3	1.72	1.07	1.82	3.58

Source: MoFE, 2019.

Table M2-2. Projection of temperature and precipitation change by season.

	RCP 4.5			RCP 8.5		
	2016-2045	2036-2065	2071-2100	2016-2045	2036-2065	2071-2100
Change in precipitation (%)						
Winter	-5.8	13.6	24.4	7.2	5.0	20.9
Pre-monsoon	-5.0	-7.4	-7.8	-4.0	4.2	-3.1
Monsoon	2.7	9.4	12.4	7.8	13.6	27.1
Post-monsoon	18.6	20.3	16.5	6.0	19.0	22.9
Change in temperature (°C)						
	RCP 4.5			RCP 8.5		
Winter	1.0	1.5	2.1	1.2	2.0	4.0
Pre-monsoon	0.7	1.0	1.2	1.0	1.6	3.4
Monsoon	0.8	1.1	1.4	0.8	1.5	3.0
Post-monsoon	1.3	1.8	2.5	1.4	2.4	4.5

Source: MoFE, 2019.

Table M2-3. Climate in Nepal 2050, according to scenarios A1b and B1.

Parameter	A1b	B1
Mean summer temperature	Will increase by 3-4°C in the western and central <i>terai</i> and by 2-3°C in the eastern <i>terai</i> . The hills and mountain will experience a more heterogeneous situation.	Will increase by 2-3°C in the <i>terai</i> zone. Hill and mountain zones will evolve more heterogeneously and many areas might show increases of 1-2°C.
Mean winter temperature	Changes will be similar to those for the summer season. The western <i>terai</i> might show an increase of 3-4°C, and the central and eastern <i>terai</i> one of 2-3°C.	Will increase by 2-3°C in the western <i>terai</i> , while the eastern <i>terai</i> might show an increase of 2°C.
Annual rainfall	The hill zone will experience a rainfall decrease of more than 100 mm, especially in the eastern region. Overall, the country will experience annual rainfall decreases of between 20 and 100 mm.	Annual rainfall will decrease by more than 100 mm in eastern Nepal and by between 20 and 100 mm in other parts of the country. The only stable exceptions might be the central and extreme western <i>terai</i> and the central mountain zone.
Monsoon rainfall	Will have a similar spatial pattern to the present. The strongest decrease will be in eastern Nepal. The western mountain zone and the central <i>terai</i> might maintain their current rainfall levels.	Will decrease in eastern Nepal, while other region will appear almost stable or with minor changes. The eastern region will lose more than 100 mm of rainfall during the monsoon season, while the central mountain zone will increase its rainfall values.
Contribution of monsoon rainfall to annual rainfall	The contribution will decrease in the eastern region, particularly in the mountain zone, and will increase by 1-3% in the western mountains.	The contribution might not change in the <i>terai</i> zone, except in eastern parts, where it might decrease, as in the eastern mountain zone.

Source: Selvaraju et al., 2014; FAO, 2014

Links<https://worldoceanreview.com><https://serc.carleton.edu/eslabs/weather/2.html><https://www.businessinsider.com/charts-and-statistics-on-global-warming-climate-change-2015-12><https://www.nasa.gov/topics/earth/index.html><https://www.sciencedaily.com/releases/2018/09/180913142050.htm>http://www.climate-change-knowledge.org/earth_system.html<https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/basics-of-climate-change/www.cen.org.np><https://public.wmo.int/en/about-us/FAQs/faqs-climate><http://cowgeneration.com/2017/09/20/the-global-warming-hoax-and-the-fake-science-behind-climate-change/><https://climate.nasa.gov/evidence/><https://www.ipcc.ch/report/ar5/wg1/observations-atmosphere-and-surface/>

Session II: Impacts of Climate Change on Agriculture and Livelihoods

Time:	90 minutes
Methods:	PowerPoint presentation, question and answer, discussions, quizzes
Materials:	Handouts, LCD projector, laptop, flipcharts, markers
Objectives:	Understand how climate change is affecting subsectors of agriculture and how that is leading to food insecurity and a threat to livelihoods.
Notes to facilitators:	<p>Start with a question: How do you think climate change affects crops, forests and biodiversity, health, water resources, tourism, pastureland, livestock herding and infrastructure?</p> <p>Have groups discuss the impacts of climate change on agriculture and current adaptation measures. One group can choose crops, another livestock and a third group fisheries. If there is a fourth group, that group can choose forests and water resources. This exercise can be combined with identification and prioritisation of adaptation options.</p>

Instructions for Facilitators

This session will provide the conceptual background to the effects of climate change on agriculture, particularly on crops and livestock and their relation to overall livelihoods. It is equally important to examine the effects of agriculture on climate change at local, national and regional levels and how agriculture plays a role in adapting to these changes.

1. Introduce the session objectives and key topics to be covered including various methods used during the session.
2. Highlight that the module has both lecture and practical sessions and involves participants actively sharing information about their experiences using examples and case studies.
3. Participatory brainstorming on impacts of climate change on agriculture and livelihood through discussion and summarization of key messages in writing using metacards or flip charts and ask participants to present their results.
4. Short documentary on good practices in agriculture.

Global Impacts on Agriculture

Climate change and global warming have already affected agriculture and will continue unabated if the current trend continues. Agriculture is highly sensitive to changes in precipitation and temperature. The IPCC Fifth Assessment Report identifies increased food insecurity due to reduced crop yields across the world as a main risk (IPCC, 2014). Higher temperatures not only melt ice that discharges water, but warmer water expands, resulting in rising sea levels and flooding in low-lying areas, which has negative impacts on farm production. Impacts on arable crops are easily seen as biological changes such as changes in flowering and harvesting seasons, quality changes and the shifting of areas suitable for cultivation. It also affects the overall agricultural ecosystem through increased pest and disease attacks, and changes in biodiversity patterns. We can observe biological changes in livestock, particularly in fertilization and breeding. This has implications for livestock feed, for example changes in pasture productivity. Besides crops and livestock, climate warming has impacts on water level rise which results in low and high water flow. Increases in precipitation by climate change leads to an increased outflow while the temperature rise increases evaporation resulting in a reduction of outflow. Overall, this has implications for agricultural productivity including changes in crop growth and changes in energy and moisture content in fields.

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 3

- Global Level Impacts on Agriculture
- Impacts on Crops
- Figure 15. Flow of climate change impacts on agricultural sector.

Impacts on Crops

The changes in temperature and rainfall patterns have significant consequences on crop production which then reduces yields of major crops like rice, wheat and maize. In mountain areas, where cool temperatures constrain crop growth, an increase in temperature levels may increase plant growth and yields. However, in Terai regions where there are excessive temperatures, too little and too much precipitation could harm crops and reduce yields, posing serious challenges for productivity. Nine out of 10 major cultivated crops will experience reduced growth rates including rice, wheat and maize, which support almost 60% of the world population energy requirements. The reduced growth rate has implications for increases in average prices by at least 75% in the major cereal crops by 2030.

See the following sections, figures and tables in the Handbook.

Chapter 3

- Figure 16. How climate change will affect agriculture in different regions, 2050 and 2080.
- Figure 17. Projected impact of climate change on agricultural yield between 2003–2080.
- Figure 18. Impact of climate change on agriculture and crop price: (A) past, (B) trend and (C) projections.
- Figure 19. (A to D) Estimated net impact of climate trends for 1980–2008 on crop yields for major producers and for global production.
- Figure 20. Damage and loss in agriculture as share of total damage and loss across all sectors (2006–2016) by type of hazards.

It is estimated that in the medium to long term, climate changes will lead to negative effects on yields. These effects will be more severe in lower than in higher latitudes. Depending on the scenario used, researchers estimate that with no adoption of climate adaptation measures, maize yields could decrease by 45 percent, wheat by 50 percent, rice by 30 percent and soybeans by 60 percent, compared with simulations that do not include climate change (FAO, 2016b). The impact will vary with crops and with time and space.

- The future climate will have greater impact on smallholder farmers in poor countries. For instance, Asia will have an 8% decline on average in eight crops by 2050.
- C3 plants such as rice, wheat, soybeans, fine grains, legumes, and most trees will be affected more but C4 plants such as maize, millet, sorghum, sugarcane and many grasses will be affected less due to differences in photosynthetic efficiency.
- Tropical countries are already the hardest hit by climate change and will likely be more so in the future. In the SRES A 1F scenario, rice yields will decline drastically in **almost all** African and Mesoamerican countries by 2028 as compared to a baseline period of 1970–2000. The Northern hemisphere will benefit from global warming because more areas will become favorable for agriculture.
- Europe, Eurasia, North America and China will gain from the increase in temperature because the climate will gradually become warm enough to grow more crops and get higher yields.
- Climate Change, Agriculture and Food Security (CCAFS) estimates show that maize, wheat rice, beans and pasture have been **significantly** affected by temperature rise. For instance, prices of different crops in Australia, Russia, USA, India, and Argentina are already affected by climate change.

- Estimates show maize and wheat yields have declined in several countries across the world, mainly in Brazil (8%), China (7%) and France (3%), for maize and Russia (14%), France (5%) and China (2%) for wheat.
- By 2030, it is estimated that rice, wheat, maize, beans and pasture yields will decline in northeast Brazil, Central America, East Africa and New Zealand.

Crop	Global production, 1998-2002 average (millions of metric tons)	Global yield impact of temperature trends (%)	Global yield impact of precipitation trends (%)	Subtotal	Global yield impact of CO2 trends (%)	Total
Maize	607	-3.1 (-4.9, -1.4)	-0.1 (-1.2, 0.2)	-3.8 (-5.8, -1.9)	0.0	-3.8
Rice	591	0.1 (-0.9, 1.2)	-0.2 (-1.0, 0.5)	-0.1 (-1.6, 1.4)	3.0	2.9
Wheat	586	-4.9 (-7.2, -2.8)	-0.6 (-1.3, 0.1)	-5.5 (-8.0, -3.3)	3.0	-2.5
Soybean	168	-0.8 (-3.8, 1.9)	-0.9 (-1.5, -0.2)	-1.7 (-4.9, 1.2)	3.0	1.3

Figure M2-2. Median estimates of global impacts of temperature and precipitation trends, 1980–2008, average yields for four major crops. Source: Lobell et al. 2016.

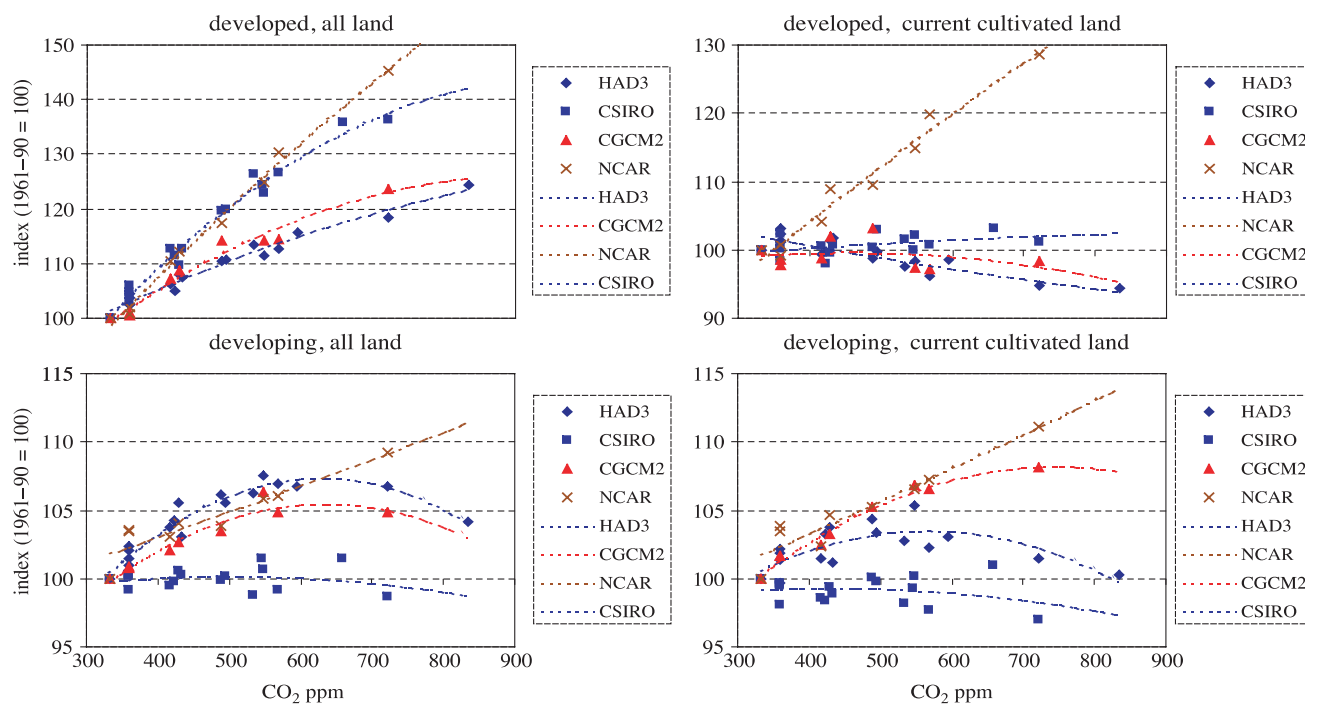


Figure M2-3. Changes in potentially attainable cereal production predicted by AEZ under different GCM climate change scenarios versus CO₂ concentration. Projections are for either current cultivated land (right), or all available under future climates (left), and pooled into developed (top) and developing (bottom) countries. Results are expressed against an index of climate change (Z100 in 1990), a proxy for time from 1990 to 2080. Source: Fischer et al. 2005.

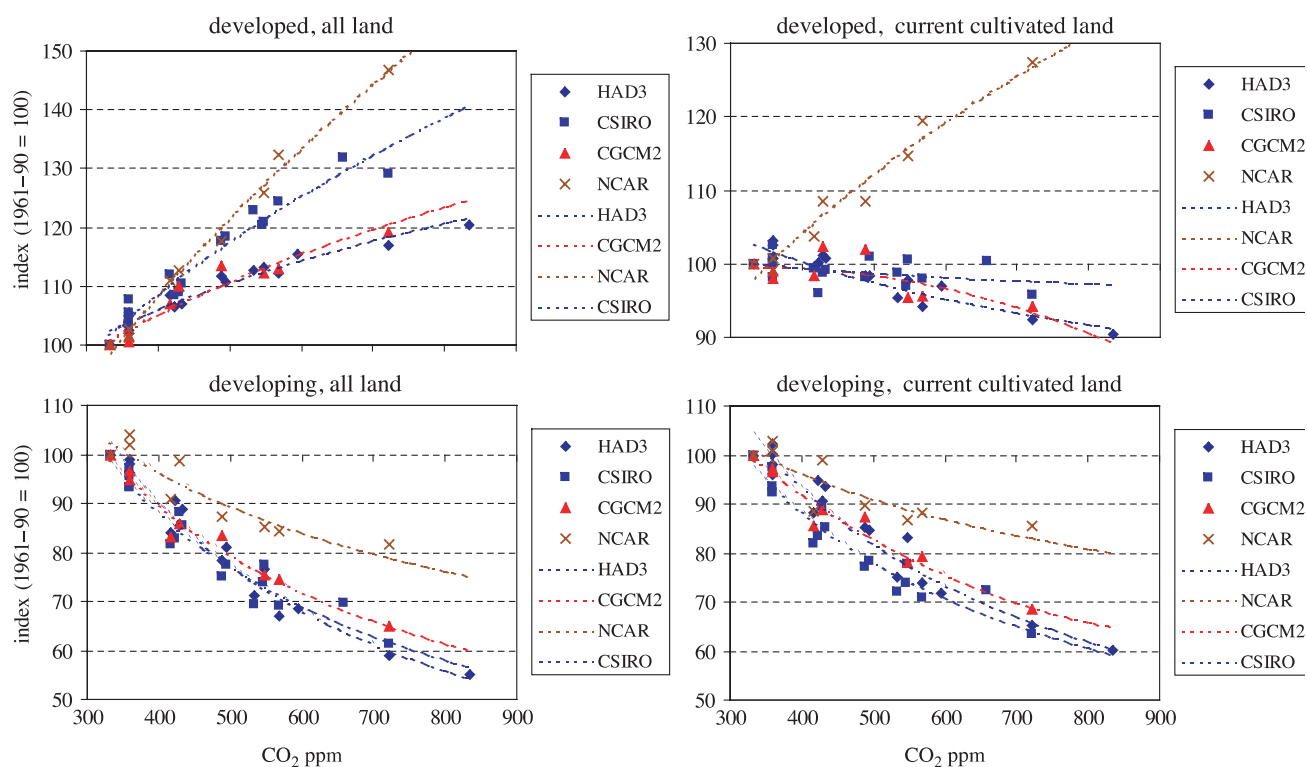


Figure M2-4. Changes in potentially attainable wheat production predicted by AEZ under different GCM climate change scenarios versus CO₂ concentration. Projections are for either current cultivated land (right), or all available under future climates (left), and pooled into developed (top) and developing (bottom) countries. Results are expressed against an index of climate change (Z100 in 1990), a proxy for time from 1990 to 2080. Source: Fischer et al. 2005.

Impact on Livestock

Livestock is an integral part of livelihood support for most households in Nepal. Climate change will increase the vulnerability of livestock and will cause loss of household income and declining crop yields. The direct impact to livestock is through reduced water availability, loss and decline of local fodder and grasses as well as quality of range land and pasture. Increased variability in precipitation can lead to water logged ground and to shortages of drinking water, and increasing vulnerability to disease. Higher temperatures cause heat stress and make animals less resistant to pathogens (Figure 21 in the Handbook).

Livestock provides 17% of global kilocalorie consumption and 33% of global protein consumption (Rosegrant et al., 2009). The sector contributes to the livelihoods of one billion of the poorest people in the world and employs close to 1.1 billion people (Hurst et al., 2005). Livestock production is likely to be adversely affected by climate change, mediated through the competition for land and water, and will have impacts on food security (Thornton, 2010). Climate change will affect livestock production through competition for natural resources, quantity and quality of feeds, livestock diseases, heat stress and biodiversity loss, while the demand for livestock products is expected to increase by 100% by 2050 (Garnett, 2009). In Asia, the loss in agricultural production in crops and livestock was high, particularly in 2008 and 2015. The estimated loss was over USD 9 billion observed mainly in southern Asia due to monsoon floods and earthquakes reported during the time period (Figure M2-20).

See the following sections, figures and tables in the Handbook.

Chapter 3

- Figure 21. Climate change effects on livestock keepers and production.

Additional materials

Figure M2-5. Total loss in crop and livestock production due to natural disasters in Asia. Source: FAO, 2017.

Impacts on Fisheries and Aquaculture

Fisheries and aquaculture employ an estimated 200 million people directly and indirectly, of which women account for about 19 percent (primary sector alone) and 50 percent if primary and secondary sectors are combined (FAO, 2018). Total global production from the fisheries sector, excluding aquatic plants, was 171 million tonnes in 2016, with 53 percent of this total coming from capture fisheries (FAO, 2018). Total landed value was estimated at USD 362 billion (FAO, 2018).

See the following sections, figures and tables in the Handbook.

Chapter 3

- Figure 22. Impacts of climate change on fisheries and aquaculture (A) and regional variability of impacts (B).

Impact on Agriculture in Nepal

Nepalese farming communities are highly vulnerable to the impacts of climate change that manifest in the form of untimely monsoons, droughts and higher temperatures. The most severe impacts on agriculture and food security are expected to be in the form of loss of arable land from flash floods and landslides, accelerated soil degradation and loss of soil fertility, outbreaks of new pests and diseases, shortage of water for crop production and uncertainty of precipitation that will directly affect rainfed agriculture, particularly in the mountain areas. There is a growing certainty that the extreme weather events will increase in frequency and intensity.

See the following sections, figures and tables in the Handbook.

Chapter 3

- Figure 23. Speculative impacts of climate change on agriculture.
- Figure 24A. Percentage change in rice yields from climate change, relative to baseline period (Left) and total change in rice yields from climate change (based on production area), relative to baseline (Right).
- Figure 24B. Percentage change in maize yields (Left) and wheat yields (Right) relative to baseline period.

Additional materials

The Post Flood Recovery Needs Assessment Report of the 2017 September flood (NPC, 2017) revealed that about 58% of the total effect was in agriculture, livestock and irrigation subsectors (Figure M2-24-25). The report calculated an economic loss equivalent to USD 69.5 million in agriculture (11.9%), USD 102.7 million in livestock (17.6%) and USD 168.1 million in irrigation (28.8%).

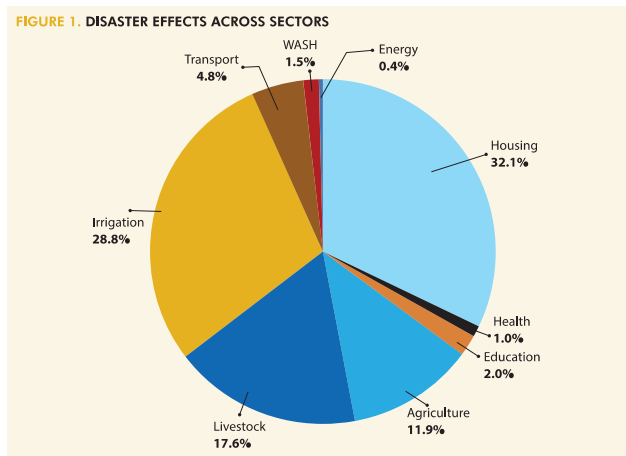


Figure M2-5. Effects of 2017 flood on different sectors. Source: NPC, 2017.

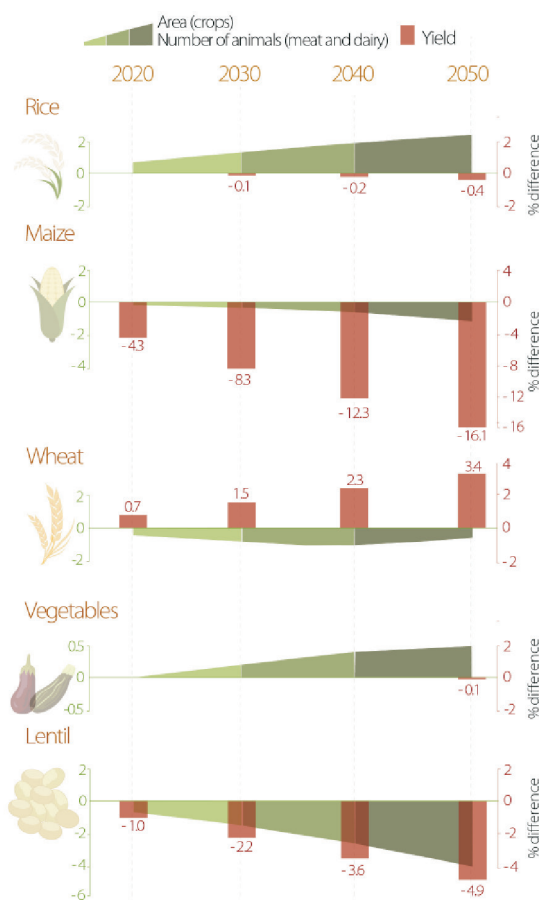


Figure M2-6. Climate change impacts on yield, crop area, and livestock numbers in Nepal. Source: CIAT, World Bank, CCAFS and LI-BIRD.

The population of indigenous livestock breeds is in sharp decline mainly because of disease outbreaks linked to a changing climate. However, local breeds of goats and yaks are more resilient to water, fodder and forage shortages (Koirala and Bhandari, 2018).

Session III: Climate Change Vulnerability and Risk Assessment

Time:	270 minutes
Methods:	PowerPoint presentation, question and answer sessions, discussions, quizzes
Materials:	Training materials, LCD projector, laptop, flipcharts, markers
Objectives:	To learn about climate change vulnerability and risk assessment (VRA) and to become familiar with vulnerability and risk assessment tools and techniques and develop skills using NAP-Ag project tools.
Notes to facilitators:	<p>Ask participants whether they know about IPCC 2007 and IPCC 2014 frameworks. Give a presentation about the difference between these two frameworks. Highlight what new information was introduced in the 2014 framework.</p> <p>Present several examples of VRA including government work and AEZ approaches. Show examples.</p> <p>Split into groups and have each group do separate exercises, preferably different steps of VRA.</p>

Climate Change Vulnerability and Risk

The concept of vulnerability and risk has evolved over time (Figures 25 and 26 in the Handbook). Before the new framework developed in Assessment Report 5 (AR5) of the IPCC was widely accepted, the most commonly adopted concept was vulnerability is the function of exposure, sensitivity and adaptive capacity if a region is in an area with high climate change hazards. If the area or people are likely to be affected by hazards, that would be considered sensitive. Exposure and sensitivity combined comprise an impact. Adaptive capacity is the ability to adjust or cope with the impact caused by hazards.

AR5 developed a new framework for risk and vulnerability. In this revised framework, risk is taken as the ultimate factor measuring climate change threat or impact on human lives. Risk is a function of hazard, exposure to hazard and vulnerability to hazard, where vulnerability is a function of sensitivity and adaptive capacity. Risk of climate impacts results from the interaction of climate hazards with vulnerability and exposure of human and natural systems. Mitigation and adaptation activities are socioeconomic processes that influence both drivers and impacts of climate change.

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 4

- Figure 25. Conceptual framework of vulnerability and risk adopted by AR4 and AR5
- Figure 26. Illustration of the core concept of IPCC WGII AR5
- Climate Change Vulnerability and Risk Assessment

Definitions of terms used in the framework which guide the overall assessment and analysis (IPCC 2014b).

Hazard: The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. In the climate change context, the term hazard refers to climate-related physical events or trends or their physical impacts.

Exposure: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

Extreme weather event: An event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be in the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics of what is called extreme weather may vary from place to place. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).

Adaptive capacity: The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities.

Vulnerability and Risk Assessment Methodologies

A range of methods and tools can be used to assess climate change risk, vulnerability, and impacts. These include quantitative and predictive models, empirical studies, expert judgement, and experimentation. Participatory and qualitative methods are also used to assess vulnerability and risks. Most participatory or community-based vulnerability assessment frameworks avoid mathematical models and quantitative generalizations of community vulnerability.

See the following sections, figures and tables in the Handbook.

Chapter 4

- Table 7. Main features of vulnerability and risk analysis tools used by different organizations.

Additional Materials

Table M2-4. A comparative matrix of vulnerability analysis tools and frameworks for use in the BCR project. Source: Morgan 2011.

Tool or framework	Scale	Measures of exposure	Measures of sensitivity	Measures of adaptive capacity	Suitability for BCR projects	Coastal and marine climate context-specific	Additional information
IUCN framework	Multiple	Through climate scenarios but left up to the user	Through assessing how many people depend on climate sensitive resources	Through series of indicators designed to be implemented at community level	High	Through the use of indicators at multiple levels	Focus on adaptive capacity and implementing resilience-building policies and projects in communities.
CARE CVCA	Multiple	Yes	No specific indicators but can be modified	Yes	High	No	Focus on creating an enabling environment within institutional frameworks for adaptation activities. Integrates concepts from livelihoods approach and disaster risk reduction. Provides more practical guidelines for implementation than IUCN framework.
World Bank VA	Multiple	Yes	Yes	Via bottom-up approach complementing a top-down approach involving narrative scenarios and possible futures. These two analyses are brought together in the final risk assessment	Low	No. Designed for fresh water ecosystems and catchment management	Risk-based approach which involves assessing risk and developing adaptive responses. Ecosystem focus. Original example based on dividing focus area into tributaries and carrying out analysis based on identifying thresholds of concern in each unit. Suggested in the literature that these units can be socioeconomic in nature, although does not provide any specific guidance.
CRISTAL	Community	Yes	–	Yes	Medium	No	Ancillary support tool to be used to measure how effective development projects are at community level at addressing climate change vulnerabilities and facilitating adaptive capacity. Strengths lie in providing a platform for community engagement concerning climate adaptation. Not a stand-alone tool and should be used in conjunction with another framework or tool.
DIVA	National or regional	Yes	No but can determine sensitivity	No but can determine adaptive capacity	Medium	Yes	Ancillary support tool designed to provide national and regional sea level rise predictions and consequences.

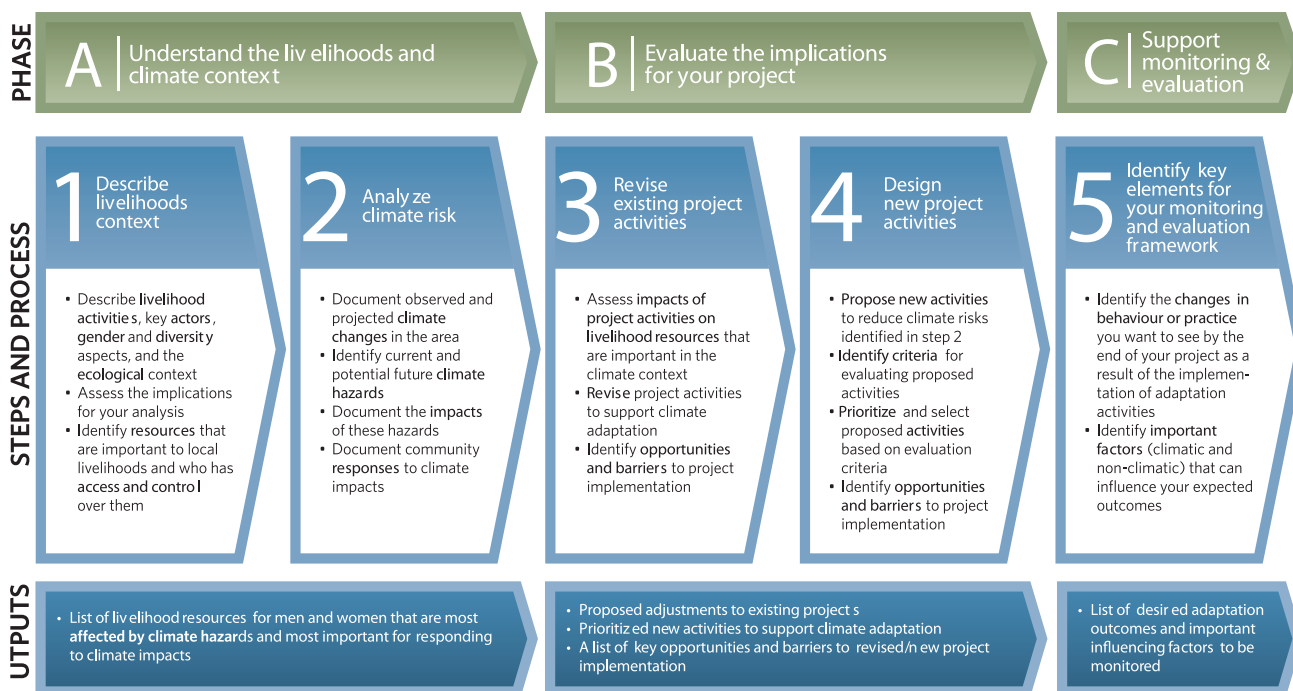
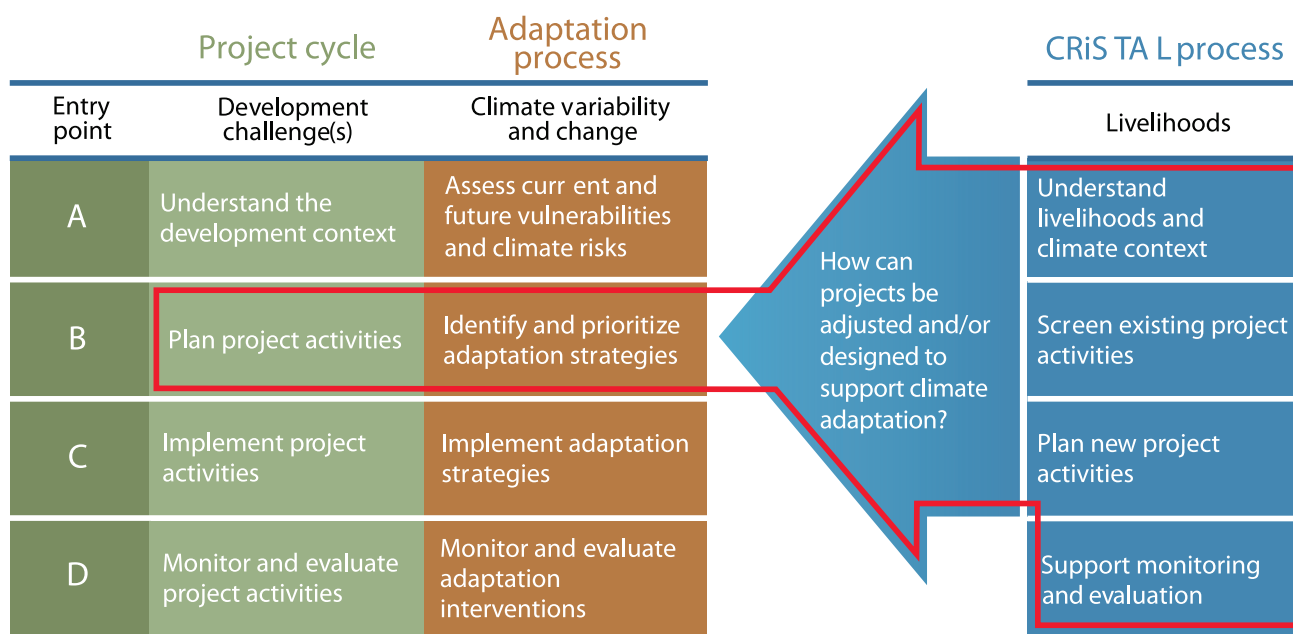


Figure M2-5. CRISTAL framework.



Figure M2-6. DFID framework.

Agro-ecological Zone Vulnerability and Adaptation Planning: An Example from PWC

Price Water Commission (PWC), with support from UNDP, carried out a climate change risk and vulnerability assessment of agro-ecological zones of Nepal and appraised climate change adaptation measures in agriculture. Temperature, moisture index, topography (elevation and slope) and soil data were used to identify agro-ecological zones (AEZs).

See the following sections, figures and tables in the Handbook.

Chapter 4

- Figure 27. Methodology applied for delineating AEZs.

VRA Methodologies Adopted by the Government of Nepal

See the following sections, figures and tables in the Handbook.

Chapter 4

- Table 8. Main methodological steps followed for VRA.
- Figure 28. Methodological framework adopted by Nepal's NAP process.
- Figure 29. Maps generated from the vulnerability and risk assessment.

A few attempts have been made to assess climate change vulnerability and risk in Nepal, where several biophysical, socioeconomic and accessibility-to-service infrastructure parameters were considered and the mapping and assessment was done at district level.

See the following sections, figures and tables in the Handbook.

Chapter 4

- VRA Methodologies Adopted by Government of Nepal

Methodological Process Adopted by NAP-Ag

The IPCC Framework considers risk a function of hazard, exposure, and vulnerability. Although there are various methods of VRA, agriculture CCVRA assessment has adopted the methodology and framework developed by Nepal's NAP process offered in the report of IPCC AR5 2014 which has put forward a concept of 'risk' in addition to 'vulnerability' and emphasized social context in the view that vulnerability can be independent of physical events. The IPCC Framework considers risk a function of hazard, exposure, and vulnerability (Table 8 in the Handbook).

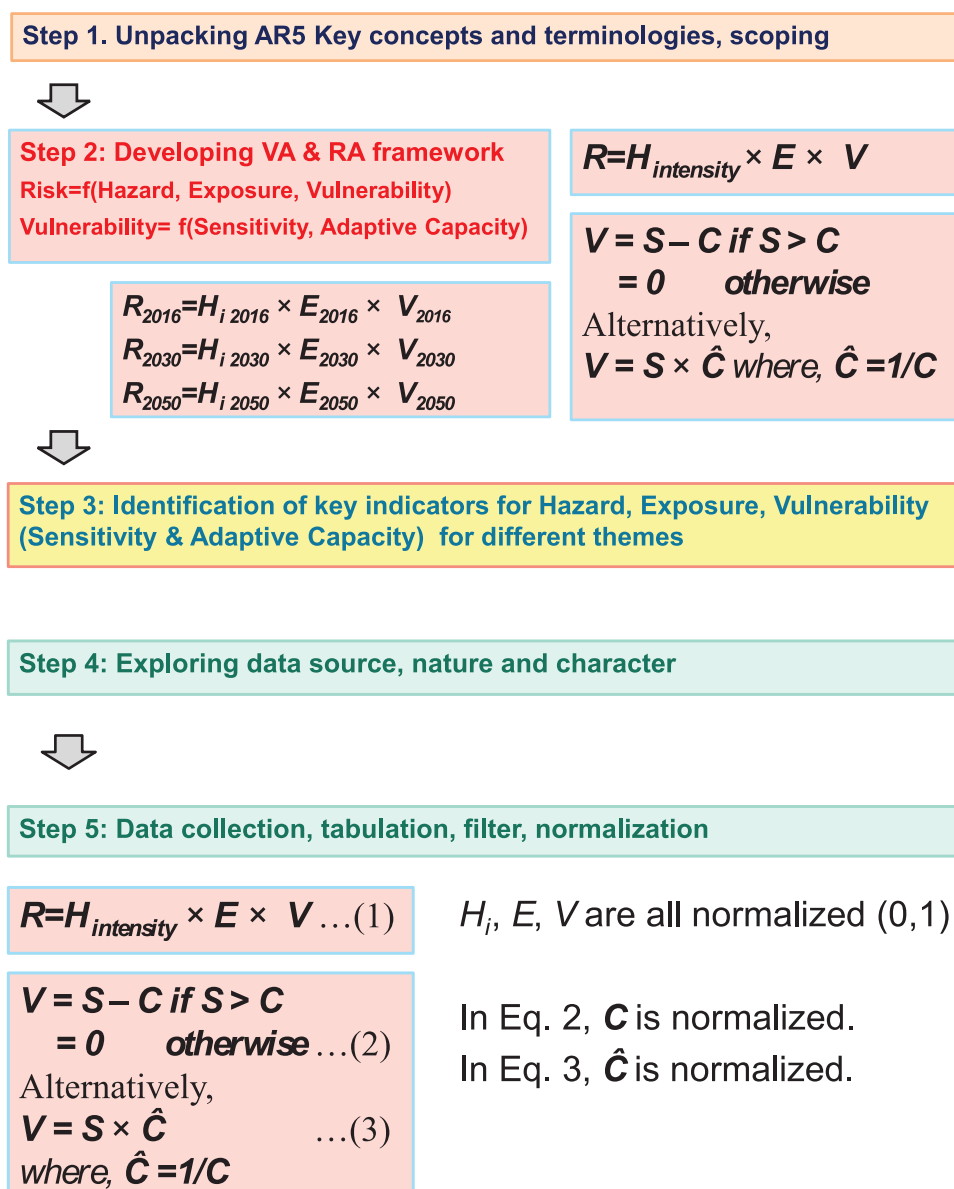
See the following sections, figures and tables in the Handbook.

Chapter 4

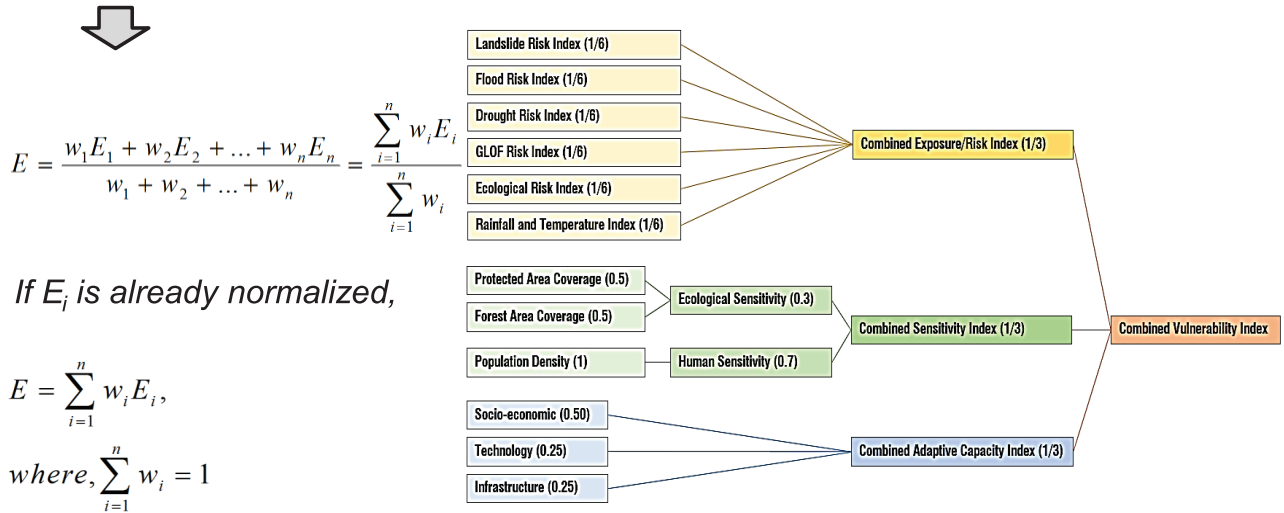
- Table 8. Methodological steps followed for VRA.

Additional Materials

Figures M2-30 and 31 below shows a step-by-step methodology in pictorial form and provides additional details in each step using symbols to give more in-depth understanding about how calculations are performed.



Step 6: Weightage and composite value



Step 7: Individual and composite maps

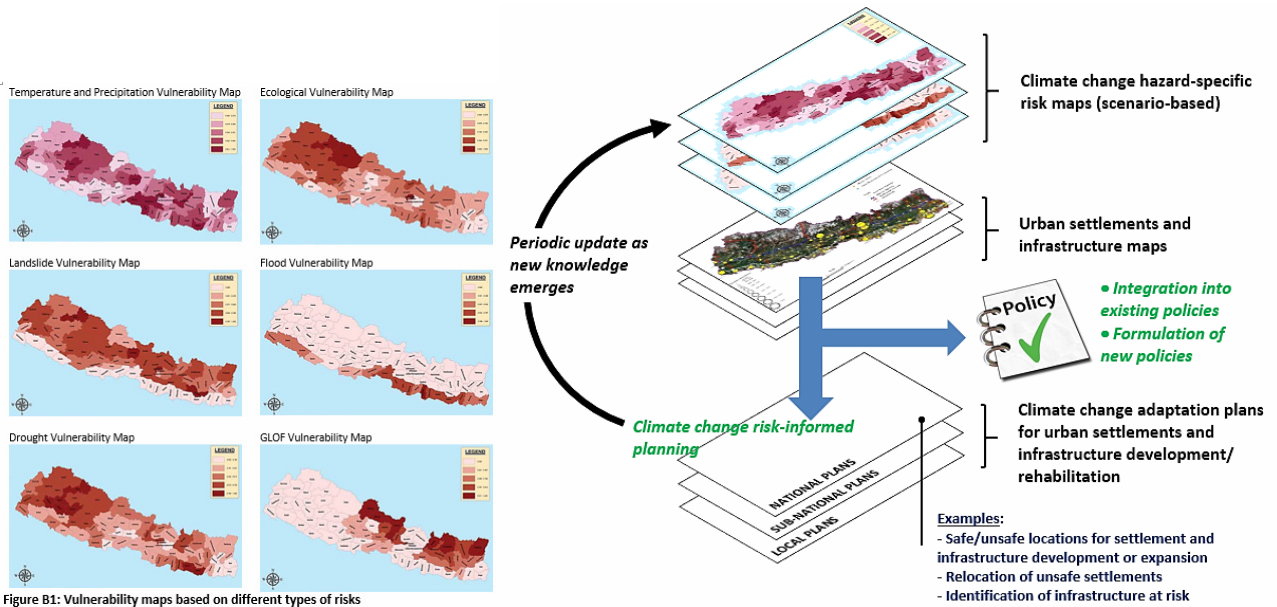


Figure M2-7. Steps of VA-VRA process adopted in Nepal. MoPE, 2017.

Additional details for Step 2

See the following sections, figures and tables in the Handbook.

Chapter 4

- o Figure 28. Methodological framework adopted by Nepal's NAP process.

Additional details for Step 3

Table M2-5. List of indicators used for hazard, exposure, sensitivity and adaptive capacity.

Indicator	Data source	Type of data
EXPOSURES		
Farming dependent population (agri, horti, apiculture and livestock)		Population
Irrigation schemes	District profile	Length of irrigation canal and number and area of reservoirs
Agriculture	CBS, agri-stat, district profile	Area
Livestock population	CBS, agri-stat, district profile	Number
Horticulture	District profile	Area
SENSITIVITY		
Livelihood dependency on agriculture	CBS, agri-stat, district profile	Population
Farming system (rainfed)	District profile	Area
Seasonal migration	CBS, agri-stat, district profile	Population
Adaptive capacity		
Availability of irrigation, coverage and type	CBS, agri-stat, district profile	Area
Transportation facilities (road types), market places, collection centers and godowns	District profile	Length of roads, and number of market places, collection centers and godowns
Farmers' groups, cooperatives and networks	District profile	Number
Policy, programme and project support, DRR and CC adaptation plans	District profile	Number
Agro industries, enterprises and employment	CBS, agri-stat, district profile	Number
Hazards		
Extreme events Extreme heat Consecutive dry days Consecutive cold days Heat waves Cold waves (fog) Extreme weather variability	DHM, local consultation	Meteorological units
Agriculture drought/ dry spell		
Landslides	District profile	Area
Flood/crop inundation	District profile	Area
Pest and disease outbreaks	District profile	Number
	Agri-stat, district profile	Number

Table M2-6. Example of sensitivity matrix. Source: NPC, 2011.

AGRICULTURE Point of Entry	Anticipated Impacts	Insects/diseases	Shift in planting flowering time	Soil moisture depletion	Loss of fertility	Loss of forage	Loss of land	Ripening period	Inundation	Weed infestation	Storage	Livestock habitat change	Livestock diseases	Others
		Temperature	H	H	H	-	H	-	H	-	M	M	M	H
Sedimentation	-	-	H	H	H	H	-	-	M	-	M	-		
Floods	M	-	-	-	M	H	-	H	-	H	-	M		
Drought	H	L	H	M	H	-	L	-	M	M	H	M		
Mass wasting (debris, landslide, gully)	-	-	H	H	M	H	-	-	M	-	-	-		
Erosion	-	-	M	H	M	-	-	-	M	-	M	-		
Water source depletion	M	-	H	M	H	-	-	-	M	-	M	-		
Humidity	H	L	L	-	-	-	-	-	M	H	M	H		
Frost	-	H	-	-	H	-	M	-	-	-	-	-		
Fog	H	H	-	-	M	-	M	-	-	H	-	M		
Hailstorms	-	-	-	-	M	-	-	-	-	M	-	-		
Any other stresses														

Session IV: Identification, Prioritisation and Integration of Adaptation Options

Time:	90 minutes
Methods:	PowerPoint presentation, question and answer sessions, discussion, quizzes
Materials:	Training materials, LCD projector, laptop, flipcharts, markers
Objectives:	To become familiar with tools and methods of identifying, prioritising and integrating adaptation options in agricultural plans, programmes and policies.
Notes to Facilitators	<p>This session will involve extensive exercises with the participants. First, run through different adaptation option identification techniques and methodologies with some examples. Split the participants in several groups (preferably three but will depend on the number of participants).</p> <p>Each group can discuss one topic (e.g. crops, livestock, fisheries).</p> <p>Ask each group to divide roles of the members, some as farmers and some as enumerators.</p> <p>The groups can make a PowerPoint presentation or use a flip chart, brown paper or other methods to take notes and present their work.</p> <p>Conduct a plenary presentation followed by discussion.</p>

Identification of Adaptation Options

Adaptation needs arise when the anticipated risks or experienced impacts of climate change require action to ensure the safety of populations and the security of assets, including ecosystems and their services. Adaptation needs are the gap between what might happen as the climate changes and what we desire to happen. In the NAPA, needs were discussed in terms of major vulnerabilities and priority adaptation activities (a hazard-based approach), but more recently, the focus has been on tackling the underlying causes of vulnerability such as informational, capacity, financial, institutional and technological needs.

Approaches to selecting adaptation options continue to emphasize incremental change to reduce impacts while achieving cobenefits, but there is increasing evidence that transformative changes may be necessary to prepare for climate impacts. Local governments, NGOs and civil society organizations are the key actors in adaptation who can accelerate bottom-up efforts of communities and households in planning and implementing their selected options.

Identifying adaptation needs from climate risks and vulnerabilities provides a foundation for selecting adaptation options. Over the years, several options have been identified but not all adaptation needs can be met and not all options will be possible. Adaptation actions have been organized into three general categories: structural/physical, social and institutional. The structural and physical options are engineering options, applying discreet technologies, and using ecosystems services to serve adaptation needs and the delivery of services from national to local level. Social options include targeting specific vulnerabilities of disadvantaged groups, including vulnerability reduction and social inequities. Institutional options involve enhancing the ability of institutions responsible for climate action.

Once VRA is complete, the next step is to identify adaptation practices suitable for the area. Technologies and practices may fit well at one location and not at another. Organizations have adopted different techniques to identify options.

Adaptation Options Recommended by UNDP in Three Pilot Districts

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 5

- Examples of Identifying Adaptation Options
- UNDP in Pilot Districts (UNDP, 2018)
- Table 9. Adaptation practices identified by UNDP

Adaptation Options Recommended by ADAPT Nepal

Adaptation options practiced by farmers, identified adaptation needs and prioritized adaptation options with the CCVRA and CCA planning case study in three pilot districts and eight selected local government units (*gaupalika/nagarपालिका*) are listed in Table 10 and 11 in the Handbook. The process involved three steps: (i) listing the adaptation measures practiced by farmers, (ii) listing adaptation needs and (iii) identifying adaptation options appropriate for the area.

See the following sections, figures and tables in the Handbook.

Chapter 5

- ADAPT-Nepal N NAP-Ag Pilot Districts (FAO, 2018)
- Table 10. Adaptation measures practiced by farmers and adaptation needs in Bardiya based on NAP-Ag project
- Table 11. Local adaptation options in Bardiya District based on NAP-Ag project

Adaptation Needs from GESI Perspective

Some communities, households and individuals are more vulnerable than others due to differing social, economic and cultural backgrounds. The Gender Equality and Social Inclusion Index (GESI) helps identify activities for the most vulnerable communities, particularly women, marginalized groups, and other socially excluded groups. Table 12 in the Handbook shows an example of adaptation needs identification for women.

See the following sections, figures and tables in the Handbook.

Chapter 5

- Table 12. Impact of CC related to GESI adaptation attempts and support acquired.

Other Adaptation Options

See the following sections, figures and tables in the Handbook.

Chapter 5

- Figure 30. Some examples of adaptation options in six sectors.
- Figure 31. Examples of adaptation options in three sectors.
- Figure 34. Climate resilient and sustainable agriculture practices.

Additional materials

Various climate risk management and adaptation practices.

Climate risk management and adaptation practices	Resource conservation and management to advance adaptation
<ul style="list-style-type: none"> • Proactive and demand-responsive seed systems • Management of high/low temperature stress • Crop diversification based on agro-ecological zones • Integrated approach to landslide risk reduction • Alternative management practices • Managing climate risks in livestock sector 	<ul style="list-style-type: none"> • Rainwater harvesting and recycling • Improvement of irrigation services • Improvement of degraded land • On-farm conservation and management of agricultural biodiversity • Improved crops and varieties for managing climate risks • Multi-story cropping and agroforestry systems • Conservation practices in rice–wheat systems

EFFECTS & IMPACTS ON:

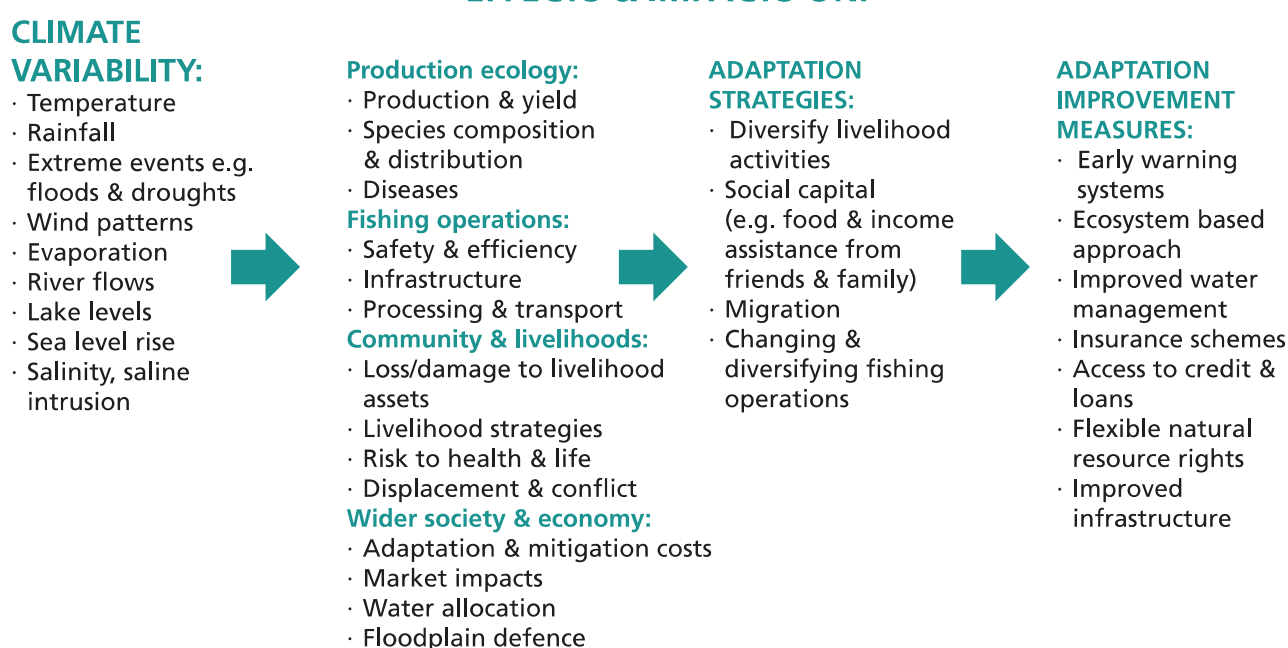


Figure M2-8. Examples of direct climate change impacts on inland capture fisheries, adaptation strategies (reactive/autonomous actions) and adaptation improvement measures (planned/long-term measures). Adapted from Badjeck et al., 2010.

The concept of climate smart agriculture is becoming popular in Nepal. These initiatives promote traditional knowledge and practices like integrated soil and water management and local water harvesting structures.

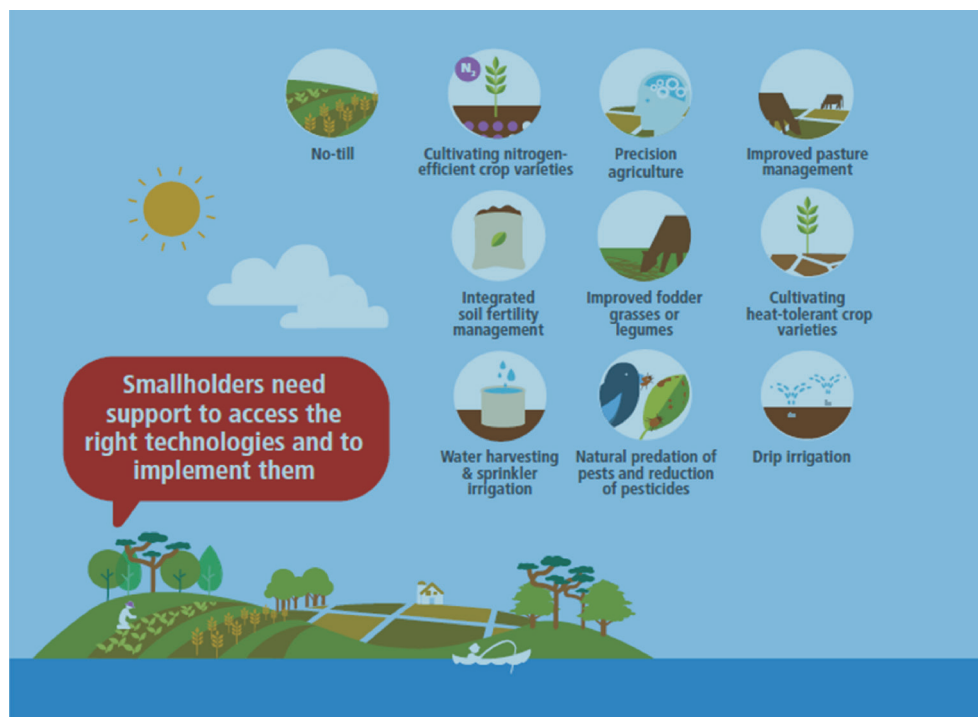


Figure M2-9. Sustainable agricultural practices. Source: FAO, 2016.

Prioritization of adaptation options

Within the climate change context, win-win options are often associated with those measures or activities that address climate impacts but which also contribute to mitigation or other social and environmental objectives. These measures include those introduced for reasons other than addressing climate risks, but also deliver the desired adaptation benefits (West and Gawith, 2005).

See the following sections, figures and tables in the Handbook.

Chapter 5

- Prioritization of Adaptation Options
- Box: The following potential adaptation options may be practical, cost-effective options.
- Box: Technology selection is guided by a number of factors.

These measures are useful when the risks associated with inaction are high, and when the uncertainty and the risk associated with introducing inappropriate adaptation measures is also high. In these cases, flexible or adaptive management approaches are useful. This involves putting into practice incremental adaptation options rather than undertaking large-scale adaptation all at once. Measures should be adopted in a sequential manner, based on an iterative evaluation of risks, costs and feasibility as knowledge, experience and technology evolve. At this stage, the adaptation team should have established the criteria for the selection and prioritization of future adaptation actions. An active involvement of stakeholders should be promoted. The actions taken will not, and do not need to meet all the selected criteria but a general rule will be that the more criteria met, the more likely the action will help reduce vulnerability to climate change (Snover et al., 2007).

Criteria for Prioritizing Adaptation Options

Choosing criteria depends on the situation, data availability, the skill of practitioners, interest of communities and existing policies.

See the following sections, figures and tables in the Handbook.

Chapter 5

- Table 13. Examples of criteria for assessing adaptation options and their impacts.
- Table 14. Indicative adaptation practices prioritized during the transact appraisal exercise of NAPA preparation.

Adaptation Option Prioritization Tools

Selection and prioritization of adaptation actions allows for choosing, rejecting or postponing actions for implementation.

See the following sections, figures and tables in the Handbook:

Chapter 5

- Table 15. Tools of climate change adaptation options selection and prioritization.

Additional materials

Some considerations for prioritisation are:

Priority 1: Actions that can be implemented in the current adaptation process.

Priority 2: Actions that require additional information, knowledge and resources before being implemented. Communities may want to explore them as part of the current planning activity.

Priority 3: Actions not suitable at this time, but could be in the future.

Selection and prioritization are important because not all options will be possible owing to constraints such as insufficient local resources, capacities and authority. The viability of an option depends on the time scale and climate scenario. Selecting options is an iterative process.

Multicriteria Analysis NAPA 2010

Multicriteria analysis (MCA) was used in NAPA in selecting the adaptation options presented in Table M2-18.

Table M2-7. Aggregate criteria and qualifiers for adaptation options prioritization. NAPA, 2010.

Criteria	Qualifiers				
Potential to reduce adverse impacts	Potential to reduce climatic hazards	Potential to help for climate change	Potential to secure or enhance ecosystem services	Potential to reduce climate vulnerabilities	Potential to reduce immediate, medium and long-term impacts
Potential to support local livelihoods	Potential to create income generation avenues	Potential to generate local employment and alternative livelihoods	Potential to ensure equity in access	Potential to secure livelihood assets	Potential to address urgent adaptation
Synergy with national priorities	Synergy with multilateral environmental agreements	Synergy with national development strategies and plans	Synergy with sectoral development plans	In line with institutional capacity to implement priorities	Potential to co-finance
People's participation	Involvement in design and implementation	Local ownership	Social and cultural acceptance	Local capacity building	Inclusiveness (Gender; indigenous & Dalit communities)
Cross-sectoral benefits	Multisectoral involvement	Ease of governance	Cobenefits (i.e. mitigation)	Multipartnership in implementation	Geographical and ecological coverage
Cost-effectiveness	Input output ratio	Multiplier effects of investment	Potential to mobilize local resources	Sustainability (expansion potential)	Potential to generate additional resources
Ease of implementation	Potential to use local knowledge and technology	Potential to enhance local and national skills and develop technology	Local and national ownership (i.e. country driven led)	Coherence with local urgent and immediate needs	Address existing or potential resource conflicts

Table M2-8. Identification and selection of adaptation options (examples).

Hazard	Adaptation option	Efficiency (1-3) A	Cost effective (1-3) B	Possibility (1-3) C	Target groups (1-3) D	Responses to risk	Total A+B+C+D	Priority
Flood	Plantation	2	2	2	2	-	8	
	Stone wall temporary	2	2	2	3	-	9	Fourth
	Gabion wall Embankment	3	1	1	3	-	8	
	Cemented wall embankment	3	1	1	2	-	7	
	Controlled grazing in river banks	3	3	3	1	-	10	Third
	Minimizing the export of sand, stone and gravel	3	3	3	2	-	11	Second
	Awareness	3	3	3	3	-	12	First

Multicriteria Analysis NAP-Ag ADAPT Nepal, FAO 2018

Multicriteria analysis was used to prioritise adaptation options in local government units selected for planning case studies. The criteria used in MCA included potential to reduce adverse impacts of climate change, potential to support local livelihoods, synergy with national priorities, people's participation, cross-sectoral benefits, cost-effectiveness, and ease of implementation. A long list of adaptation options was prepared first by the group. The initial 23 options were reduced to 10. Then, prioritization and ranking were done using multicriteria analysis. The group was asked to assign a minimum 5 marks and a maximum 20 for each option. Bansgadhi municipality is given below as an example.

Table M2-9. List of agriculture climate change adaptation programs in Bansgadhi municipality.

Agriculture sector climate change adaptation options	Location	Tentative budget
Irrigation	Ward 2 Laganiya Bandh Kuthro Bethahani	40 million
Small irrigation	Ghattelkhola (Amaiya)	5 million
	Ward 8 Jhanaiyha	5 million
	Rehu irrigation (Dangpur Bhainsasur Belauli)	10 million
Deep boring	Ward 9 Thumuni Pahadipur Durgaphanta	1.5 million
	Ward 8 Bangaudi	1.5 million
	Ward 4 Pipaltandi Materia Badhawa Newada Asnehari	2 million
Concrete irrigation canal construction	From Ward 6 Murgiya bandh	20 million
	Ward 5 South Rampur	5 million
Livestock farming	Ward 7 Sagahapur Bahunpur	
	Ward 9 Machaghar Thumani	
	Ward 1 Chepang	
	Ward 4 Madaha Ward 5 Bansgadhi	
Gangkhola bank protection	Ward 9 Thumuni Shantinagar Durgaphanta	
Rheukhola bank protection	Ward 8 Rajiphanata (Betauli)	
Boksiniya bank protection	Ward 8 Jhunaiya	
Ghoraha bank protection	Ward 5 Barhabigha	
Gyangkhola bank protection	Ward 7 Chaudhari	
Banbagiya bank protection	Ward 6 Charcha	
Murgiya bank protection	Ward 6 (near bridge)	
Uttarbhakari bank protection	Ward 3 Uttarbhakari	
Manakhola bank protection	Ward 3 Khalla	
Pachhalakula bank protection	Ward 7 Deudhakala	
Soil testing	In all nine wards	
Aquaculture	Ward 2 Banmudawa Ward 5 Chtiyatal	
	Ward 8 Laxmantal	
	Ward 9 Shantinagar Toraiya	
	Ward 7 Chhodeuda Gauripara	
	Ward 8 Kakaura	
Commercial vegetable farming	All wards including ward 8 Bhainsasur	10 million
Disaster management fund (emergency)		5 million
Climate change awareness and capacity development		2.5 million
Human resource management (agriculture and livestock)		2.5 million
Crop diversification		5 million
CC impact tolerant crop management		1 million

Table M2-10. Prioritisation and ranking of agriculture climate change adaptation programs in Bansgadhi municipality.

Option	Title of the project (Bansgadhi)	Marks out of 20	Ranking
Option B	Dudawa Khola bank protection using bioengineering technology	19	1
Option A	Babai irrigation canal, and groundwater irrigation in settlements	17	2
Option E	Agriculture and livestock health clinic centers in all wards	17	3
Option D	Commercial livestock production	10	4
Option J	Promotion of organic farming	9	5
Option C	Commercial vegetable production	7	6
Option F	Disaster management fund establishment	7	7
Option H	Climate-induced disaster mitigation capacity development	6	8
Option G	Climate change awareness development	6	9
Option I	Soil testing and treatment services	5	10

Pairwise Ranking NAP-Ag ADAPT Nepal, FAO 2018

Pairwise ranking can be done between a set of similar or entirely different activities. For example, with climate change adaptation or climate resilience planning, there might be a list of several activities recommended to control flooding. The different ways of flood control can be ranked. Similarly, there might be a list of mixed activities related to controlling floods, landslides, and deforestation and a ranking can be done to choose activities that are most immediately needed by the community. In this method, adaptation options are evaluated in pairs and one adaptation option is preferred of the two.

Table M2-11. Pairwise ranking (example).

Adaptation options	Option 1	Option 2	Option 3	Option 4
Option 1	X	Option 1	Option 1	Option 4
Option 2	X	X	Option 2	Option 4
Option 3	X	X	X	Option 4
Option 4	X	X	X	X

Results: Option 1 chosen 2x; Option 2: 1x; Option 3: 0x Option 4; 3x. Outcome: select option 4.

Adaptation	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Option A	X	B	C	D	E	F	G	H	I	J	K	A	A	A
Option B	X	X	B	D	E	F	G	H	I	J	K	B	B	B
Option C	X	X	X	D	E	F	G	H	I	J	K	L	C	N
Option D	X	X	X	X	D	F	G	H	I	J	K	D	D	D
Option E	X	X	X	X	X	F	G	H	I	J	K	E	E	E
Option F	X	X	X	X	X	X	G	H	I	J	K	F	F	F
Option G	X	X	X	X	X	X	X	H	I	J	K	G	G	G
Option H	X	X	X	X	X	X	X	X	I	J	K	H	H	H
Option I	X	X	X	X	X	X	X	X	X	J	K	I	I	I
Option J	X	X	X	X	X	X	X	X	X	X	J	J	J	J
Option K	X	X	X	X	X	X	X	X	X	X	X	K	K	K
Option L	X	X	X	X	X	X	X	X	X	X	X	X	L	N
Option M	X	X	X	X	X	X	X	X	X	X	X	X	X	N
Option N	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Results: Frequency of Option A=3, Option B=5, Option C=2, Option D=7, Option E=6, Option F=8, Option G=9, Option H=10, Option I=11, Option J=13, Option K=12, Option L=2, Option M=0 and Option N=3.

Table M2-12. List of agriculture climate change adaptation options in Rajapur municipality.

SN	Agriculture sector climate change adaptation programs	Tentative budget
1	Agriculture and livestock sector related	-
1a	Off-season vegetable farming	2 million
1b	Training on biopesticide and organic manure	3 million
1c	Improvement of animal sheds and poultry houses	5 million
1d	Climate change adaptive crop and seed production and use	3 million
1e	Crop diversification	2 million
1f	Selection of crop and farming system is adapted to changing climate	2.5 million
1g	Commercialization	5 million
1h	Mechanization	20 million
1i	Irrigation canal construction in Wards 1, 3, 4 and 7	3 million
2	Budhikulo: control, intake improvement and water filter program	1 billion
3	Canal bank protection (both sides) and canal cleaning	2 million
4	Cold storage construction (to save seeds from flooding)	3 million
5	Agriculture market management	0.5 million
6	Training and support for commercial livestock and poultry farming	50 million

Table M2-13. Preferred agriculture climate change adaptation options in Rajapur municipality.

SN	Agriculture climate change adaptation options	Tentative budget
Option A	Off-season vegetable farming	2 million
Option B	Training on biopesticide and organic manure	3 million
Option C	Improvement of animal sheds and poultry houses	5 million
Option D	Climate change adaptive crop and variety seed production and use	3 million
Option E	Crop diversification	2 million
Option F	Selection of crop and farming system is adapted to changing climate	2.5 million
Option G	Commercialization	5 million
Option H	Mechanization	20 million
Option I	Irrigation canal construction in Wards 1, 3, 4 and 7	3 million
Option J	Budhikulo control, intake improvement and water filter program	1 billion
Option K	Canal bank protection (both sides) and canal cleaning	2 million
Option L	Cold storage construction (to save seeds from flooding)	3 million
Option M	Agriculture market management	0.5 million
Option N	Training and support for commercial livestock and poultry farming	50 million

Table M2-14. Ranking of agriculture climate change adaptation options in Rajapur municipality.

SN	Agriculture climate change adaptation programs	Frequency pair wise ranking	Ranking
Option J	Budhikulo control, intake improvement and water filter program	13	1
Option K	Canal bank protection (both sides) and canal cleaning	12	2
Option I	Irrigation canal construction in Wards 1, 3, 4 and 7	11	3
Option H	Mechanization	10	4
Option G	Commercialization	9	5
Option F	Selection of crop and farming system is adapted to changing climate	8	6
Option D	Climate change adaptive crop and variety seed production and use	7	7
Option E	Crop diversification	6	8
Option B	Training on biopesticide and organic manure	5	9
Option A	Off-season vegetable farming	3	10
Option N	Training and support for commercial livestock and poultry farming	3	11
Option C	Improvement of animal sheds and poultry houses	2	12
Option L	Cold storehouse construction (to save seeds from flooding)	2	13
Option M	Agriculture market management	0	14

Note: In ranking column, 1 denotes highly preferred adaptation option.

Cost-benefit Analysis for Prioritization of Adaptation Options UNDP, 2018

Cost-benefit analysis of adaptation options carried out by PWC in connection with the Appraising Cost of Options firstly identified Ecosystem Based Adaptation (EbA) options for agro-ecological zones covering Dailekh, Bardiya and Mugu Districts based on detailed climate change risk and vulnerability assessment through spatial analysis and field validation. EbAs were prioritized through an application of cost-benefit analysis that considered valuation of ecosystem services at the watershed level to clearly identify the incremental costs and benefits of the EbA measures, medium and long term, and also took account of climate change impacts.

The CBA was carried out using methodologies as suggested by ADB (2017) and the World Bank. Costs, both CAPEX and operation and recurring maintenance costs were considered. The analysis was carried out considering financial costs at constant prices. Benefits have been identified and valued at constant prices. An example of cost-benefit analysis of adaptation options (sustainable agriculture management) carried out by a UNDP study for Mugu District is presented below.

Table M2-15. Cost-benefit analysis and input cost calculation.

S. No.	Parameter	UOM	Value
1	Total agricultural land	ha	5,854
2	% of total arable land targeted		
2.1	Total area under temporary crops	ha	5,646
2.2	Area under temporary crops targeted	ha	80%
2.3	Total area under temporary crops targeted	ha	4,517
3	cost of plastic tunnel		
3.1	Cost of production in plastic tunnel	NPR/ha	3,519,500
3.2	Area targeted for intervention	% of total area	45%
4	Revenue per ha - plastic tunnels	NPR/ha	4,625,000
5	masuli seeds		
5.1	Masuli seed requirement	kg/ha	50.00
5.2	Cost of masuli seeds	NPR/kg	350
5.3	increase in yield	kg/ha	2
5.4	Price of masuli	NPR/kg	350
5.5	Area targeted for intervention	% of total area	45%
6	Vegetables (pumpkins, gourd, etc.)		
6.1	Average seed requirement	kg/ha	5
6.2	Average cost of seeds	NPR/kg	18,200
6.3	Other costs	NPR/kg	1,055,850
6.4	Revenue per ha	NPR/kg	2,312,500
6.5	Area targeted for intervention	% of total area	10

Using a social discount rate of 5% p.a., the present values of net benefits have been calculated for 5-10 years (short term), 10-20 years (medium term) and 20-35 years (long term). The results are presented in Table M2-27.

Table M2-16. CBA for sustainable agriculture for Mugu District in Mugu Karnali watershed.

Particulars	UOM	Tenure (in years)						
		5	10	15	20	25	30	35
ENPV of costs	NPR Million	1,039	41,743	73,637	98,626	118,206	133,547	145,567
ENPV of benefits	NPR Million	-	59,692	119,384	179,077	238,769	298,46	358,154
Present value of cost per hectare	NPR Million/ ha	32.23						
Present value of benefits per ha	NPR Million/ ha	79.29						
Benefit to Cost Ratio	Ratio	2.46						
EIRR over the project lifetime	% p.a.	26%						
Climate change %	%	17%						
Payback period for initial investment	Years	5						

Table M2-17. Adaptation benefits from sustainable agriculture management for Mugu District in Mugu Karnali watershed.

Type of benefit	Relative importance from the point of view of adaptation	Anthropogenic drivers affecting benefit	Explanation
Incremental revenue from off-season vegetable cultivation	High	Drought, extreme weather conditions	Helps in utilizing land during dry seasons augmenting income sources, therefore, this measure is rated high.
Facilitate water conservation	Low	Drought	Provides for additional irrigation source during dry season in the High Mountain region. Therefore, this measure is rated low.
Increase in food security	High	Drought	Nepal is a net importer of food, with impacts of climate change the food security is threatened. Therefore, this measure is rated high.

Module 3: Implementation of Adaptation Actions

Module Overview

Once vulnerability and risk assessment are completed and promising adaptation actions are identified, the next step is integration into local plans for sustainable financing and implementation. Effective integration leads to effective implementation and quality outcomes.

This Module introduces how adaptation options are integrated into plans and policies of local, provincial and federal governments and how a budget is ensured to implement them. The Module also introduces awareness raising and capacity building methods and discusses the institutions that need to be engaged and coordination among and between them.

The Module has the following objectives:

- Introduce tools to integrate adaptation options into local, provincial and federal government plans and allocation of budgets.
- Introduce the types of institutions required, their roles and strategies to communicate, coordinate and build synergy.

Learning Outcomes

After the session, participants will:

- Be familiar with using tools to integrate adaptation options into their plans and programmes and secure a budget to implement adaptation options.
- Have the skills to independently conduct awareness raising and capacity building activities.
- Know how to bring like-minded institutions together and build synergy among them for successful implementation of adaptation options.

Session I: Integration of Adaptation Options into Plans and Policies

Time:	90 minutes
Methods:	PowerPoint presentation, question and answer, discussions, quizzes
Materials:	Training materials. LCD projector, laptop, flipcharts, markers
Objectives:	In this session, participants will learn why climate change adaptation actions need to be mainstreamed, the main entry points for mainstreaming, elements of planning and budgeting and budget coding, and local adaptation plan of action frameworks.
Tips to Facilitator	<ul style="list-style-type: none"> • Begin with a question about what participants understand about mainstreaming and integration and ask them to share examples of integration and mainstreaming of climate change adaptation measures in their own programmes or work. • Present examples of mainstreaming models adopted by different organizations in different countries. Highlight key strengths of different models. • Present the current mainstreaming options practiced at different levels of government in Nepal

Mainstreaming Climate Change Adaptation Measures

Addressing climate change requires making systemic responses to climate impacts through agricultural development programs. Separate ad hoc actions to address climate change do not bring lasting results. The National Adaptation Plan (NAP) process can serve as a mechanism for integrating climate change adaptation objectives in sector strategies. Based on the learning from NAP for Agriculture (NAP-Ag), the process of integrating climate change in planning and budgeting at the subnational level needs to be initiated without delay.

Nepal has three tiers of government, federal, provincial and local. There are seven provincial governments and 753 local government bodies, each with constitutional mandates to independently plan and implement development programs. The government's official roadmap for attaining the SDGs rests on the ability of subnational governments responsible for delivering vital public services (NPC, 2017). In line with the new federal governance system and the SDG roadmap, agriculture plans need to be developed and implemented at the subnational level.

Efforts towards integrating climate change in agricultural development plans and budgets need to extend further to the subnational level. Nepal has made significant progress in integrating climate change in plans and budgets through different entry points in public financial management systems. This integration allows planners to better address sector-specific climate risk and vulnerability through regular programs. It has also allowed for intersectoral coordination in budget allocation to climate programs.

See the following sections, figures and tables in the Handbook.

Chapter 5

- Climate Change Adaptation in Planning and Budgeting

The Government of Nepal has recently made efforts to integrate climate change in planning and budgeting across sectors to make development programmes more climate responsive. Several guidelines have been formulated and policy reforms introduced to help ministries with prioritization, budget allocation and expenditure tracking to support their climate goals.

The government recently endorsed a Climate Change Financing Framework and prepared a roadmap to guide mainstreaming climate actions into development plans and budgets and improve accountability and reporting on the effectiveness of climate investments. The roadmap is intended to guide ministries in SDG implementation and localization by ensuring that climate actions are well integrated into SDG plans and monitoring frameworks at all levels. Mainstreaming means significantly expanding and enhancing climate change adaptation measures so they

become national practice, and fully institutionalized within national, subnational and local development plans. There are two aims for mainstreaming: i) to make certain that all national, subnational and local and sectoral programmes and projects are designed with adaptation measures to reduce the potential risk of climate change, and ii) to make certain that all national, provincial, local and sectoral development programmes and projects do not increase vulnerability to climate change.

Mainstreaming Climate Change Adaptation

See the following sections, figures and tables in the Handbook.

Chapter 5

- Main Considerations in Integration
- Reasons for Integration

The subnational and local levels also matter, particularly in terms of climate change adaptation, for the following reasons:

- Development impacts are best observed and understood at the local level.
- Climate change impacts are felt at the local level.
- Vulnerability and adaptive capacity are context-specific.
- Most adaptation options require implementation at the local level.
- Initiatives pioneered at the local level may be replicated and scaled up (OECD, 2009).

For these reasons, community-based adaptation is an important aspect of climate change mainstreaming. Community-focused vulnerability and adaptation assessments are a key tool to support community-based adaptation.

Main Entry Points for Mainstreaming Climate Change in Strategic Policy and Planning Processes

Entry points for integrating climate change exist at all stages of the national and sector policy cycles, and the project cycle. Table M3-1 provides examples of entry points for mainstreaming in national development planning and Figure M3-1 for budget and programme formulation.

Table M3-1. Possible entry points for mainstreaming into national development planning.

Planning level	Entry points
National government and cross-sectoral ministries	<ul style="list-style-type: none"> ● Poverty reduction strategy paper ● National development plan ● MDG national development strategy ● National budget allocation process or review (e.g. medium-term expenditure framework, public expenditure review)
Sector ministries	<ul style="list-style-type: none"> ● Sector strategies, plans and policies (e.g. agricultural sector plan) ● Preparation of sector budgets ● Public expenditure reviews
Subnational authorities	<ul style="list-style-type: none"> ● Decentralization policies ● District plans ● Preparation of subnational budgets

Source: de Coninck, 2009

Climate Change Adaptation in Planning and Budgeting

There has been a paradigm shift in planning processes in Nepal. The Constitution of Nepal, 2015 mandated each level of government to plan agriculture development, including climate change adaptation planning. The federal government is mainly responsible for making policy, planning, and setting norms and standards at national level and also has regulatory functions. The federal Ministry of Agriculture, Land Management and Cooperatives is involved in national agricultural planning. It formulates and implements agriculture development annual plans and programmes which encompass climate change aspects.

See the following sections, figures and tables in the Handbook.

Chapter 5

- Section: Climate Change Adaptation in Planning and Budgeting
 - Adaptation planning process at national level
 - Adaptation planning process at provincial level
 - Adaptation planning process at local level

Local Budget and Planning Formulation Guidelines, 2074 entail seven steps of a budget and planning process for local government units.

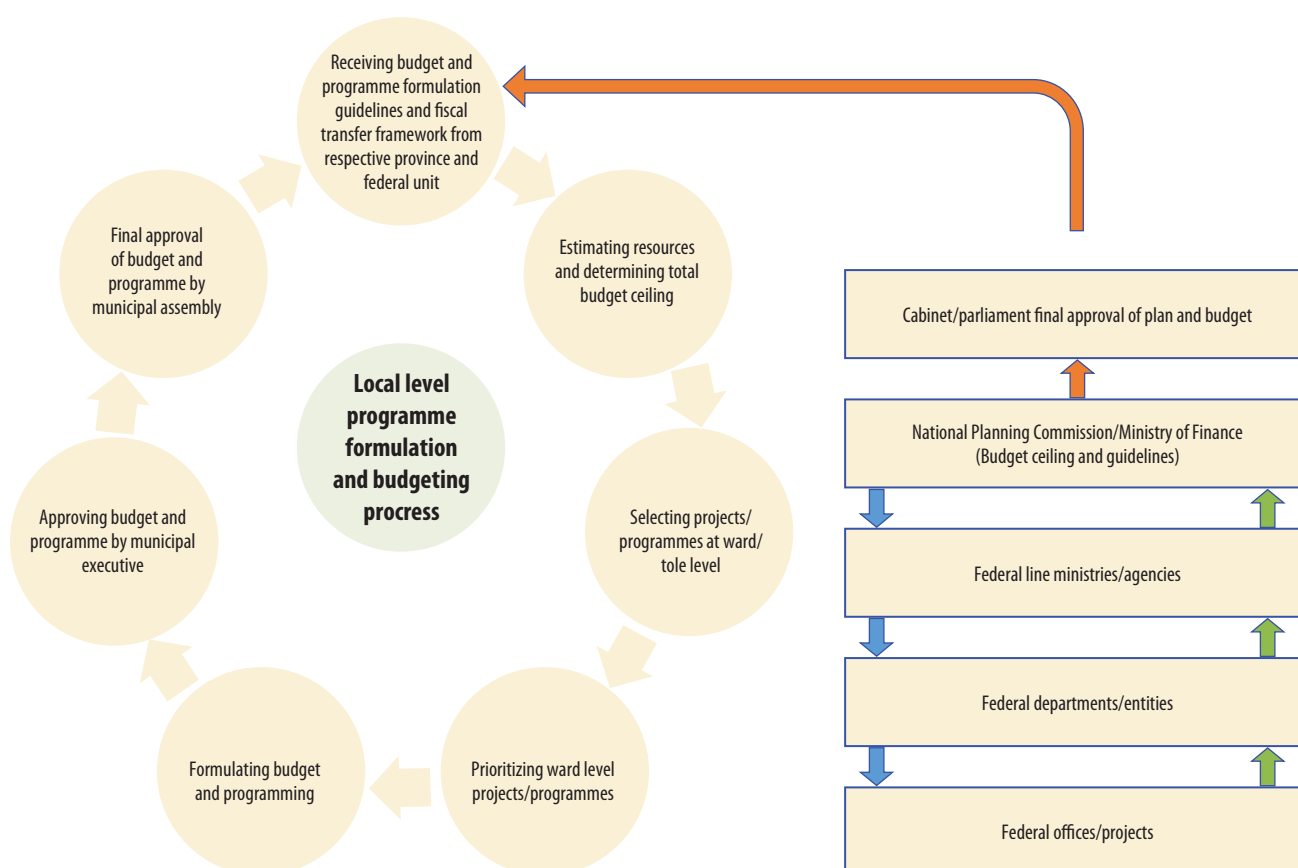


Figure M3-1. Local budget and programme formulation process.

Local Adaptation Plan of Action Framework

The government has adopted the Local Adaptation Plan of Action Framework 2011 (LAPA) that envisages integrating climate adaptation activities into local and national development planning processes. It was designed to support planners and decision makers at local-to-national level to identify the most climate vulnerable VDCs, wards, and people and their adaptation needs, prioritise adaptation options with local people setting priorities, and prepare and integrate local adaptation plans for action into local-to-national planning in accordance with the Local Self-Governance Act. This Framework can be considered a first attempt for integrating climate adaptation programmes into national and local planning. The Framework consists of seven steps for integrating climate change resilience into national planning processes. The steps involved in preparing and implementing LAPA are presented in diagrammatic form in Figure M3-2.

- Climate change sensitization
- Climate vulnerability and adaptation assessment
- Prioritisation of adaptation options
- Formulating local adaptation plan for action
- Integrating local adaptation plan for action into planning processes
- Local adaptation plan for action Implementation
- Assessing progress of local adaptation plan for action

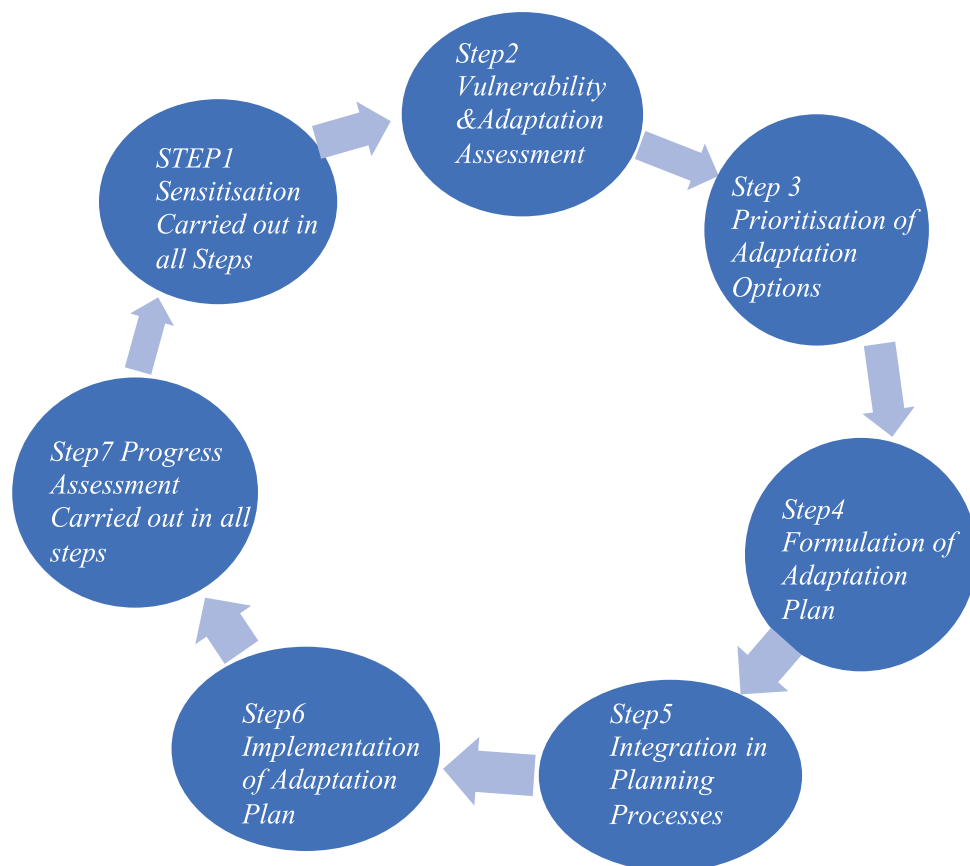


Figure M3-2. Schematic diagram of LAPA planning.

Draft Local Disaster and Climate Resilience Planning (LDCRP) Guideline, 2017

The Ministry of Federal Affairs and Local Development is in the process of issuing Local Disaster and Climate Resilience Planning Guidelines 2017, which consists of five steps:

- Coordination and initial preparations
- Vulnerability and capacity assessment
- Preparation of local disaster and climate resilient plan
- Approval, mainstreaming and implementation of plan
- Monitoring, evaluation and review.

The steps are shown in Figure M3-3 and the integration of adaptation actions adopted by NAP-Ag in Figure M3-4.

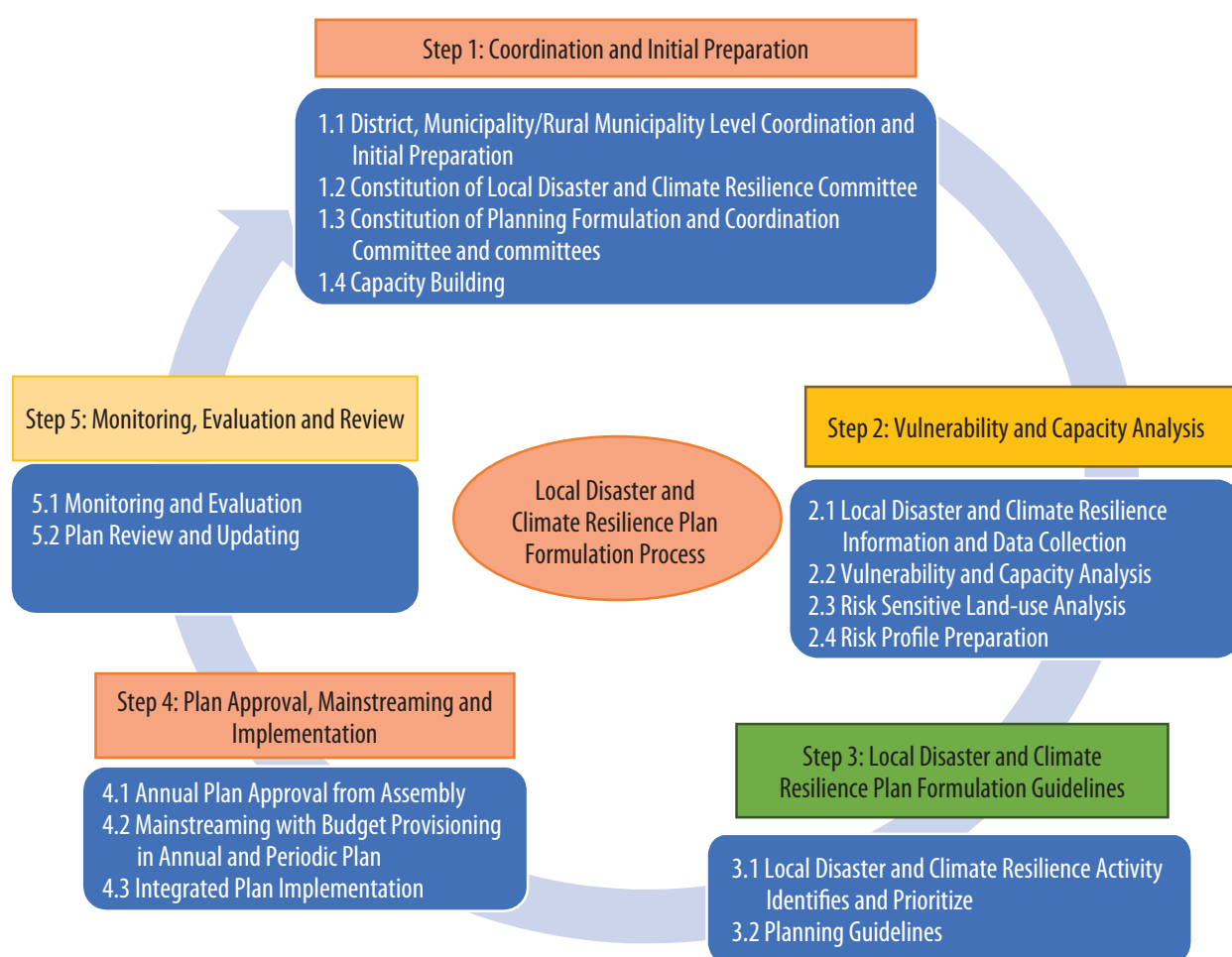


Figure M3-3. Local disaster and climate resilience planning framework.

See the following sections, figures and tables in the Handbook.

Chapter 5

- Figure 39. Integration process followed by NAP-Ag.

Improving the Climate Budget Code for Climate Resilient Agriculture Planning

Clearer budgetary guidelines for the sector can facilitate improvements in the coding system and help minimize subjective interpretation of the coding criteria applied to agricultural programs. For example, current coding criteria exclude regular programmes such as non-conventional irrigation and water harvesting from being counted as climate relevant. Such programmes are therefore budgeted outside the climate code. As an important further step in improving the planning and budgeting, the methods and criteria used to define climate programmes in the budget code need to be modified and customized to cover sector-specific requirements. More refined criteria and granulated typologies are required to better classify climate programmes to reflect sector-specific needs. The level of detail required for classifying activities needs to be rationalised to fit into the Line Ministry Budget Information System with little modification (Figure 39 in the Handbook).

See the following sections, figures and tables in the Handbook.

Chapter 5

- Figure 39. Integration process followed by NAP-Ag.
- Figure 40. UNDP support in establishing financing mechanism at country level.

Session II: Long-term Implementation, Coordination and Budgeting Strategies

Time:	90 minutes
Methods:	PowerPoint presentation, question and answer, discussion, quizzes
Materials:	Training materials, LCD projector, laptop, flipcharts, markers
Objectives:	To improve the understanding of weather, climate, weather systems, climate change trends and impact of climate change on agriculture taking into account Gender Equity and Social Inclusion (GESI) and local adaptation measures.
Tips to Facilitator	<ul style="list-style-type: none"> • Present perceptions of people in different parts of the world and ask participants if they have similar experiences • Conduct a workshop. Divide groups into a reasonable number of groups and ask them to document perceptions of people in their working area. • Briefly present about budgeting strategy in Nepal. Additional details will be covered in the following session.

Adapting to climate change is a complex process and includes activities from risk reduction and early warning systems to capacity building and livelihoods diversification. Adaptive capacity of a farmer determines his/her options and thus indicates their coping strategies. Adaptive capacity does not automatically mean that an individual will adapt, but requires their willingness to try. To realize the need to adapt the stakeholder needs to understand climate change and its impact.

Participants need to improve their confidence to use tools and techniques and understand the context. For example, ICIMOD has developed a community-based flood early warning system toolkit which could be used as reference material.⁴ Strengthening climate information mechanisms should be in place for early warning systems. An effective detection and warning system for abrupt climate variability is an important tool for climate risk management.

One important sector in need of more attention and immediate action is strengthening gender awareness and indigenous community inclusion in national policy and plans. Gender vulnerability is not adequately addressed and there is no specific strategy for dealing with the impacts of climate change on women. To increase community and household resilience to climatic and socioeconomic changes, it is therefore crucial to invest in strengthening women's capacities to manage associated risks through financial literacy training and skills training on resilient agricultural practices. Policy and decision makers need to recognize women's roles and responsibilities in agriculture, food security and natural resource management to create enabling policies and institutions that acknowledge women as vital agents of change and adaptation.

Documentation of perception and awareness level on climate change

Successful adaptation to climate change requires an awareness of the need to adapt. Below are several statements from smallholders that reflect their perceptions of climate change based on their experience.

I don't understand about climate change, since I am mostly inside the house and responsible for household activities, but last year we experienced the highest rainfall in a decade which damaged our cattle shed due to a flood. It also washed away our paddy crop. Gulab Devi Chudhary, Sunsari

The weather is not continuous. This year we experienced unpredictable weather. It is already April and we still have snow and need warm clothes. Pancha Bahadur Rai, Chyangthapu, Terathum

⁴ Accessed at http://lib.icimod.org/record/29959/files/Flood_EWS.pdf

When I came here at the time of my marriage this village was covered by forests. Only a few houses were here and we used to have high diversity of local beans in the field. Now after 45 years, the forest cover is less than half, the fields are fragmented and left fallow due to out migration. From 12 varieties now we have only three and even those are grown by very few households. Because of a shortage of water compared to the past we cannot do much in the field. Source of water is degraded due to deforestation. Jaymati Badal, Khar, Darchula

People in many rural areas manage risks associated with perceived climatic variability especially crop failure. In recent years, farmers in the hilly areas grow potatoes as a crop substitute for grains and the yield is satisfactory compared to cereal grains. Local farmers have also diversified their crops, particularly vegetables and fruits. Through crop diversification and alternative crop planting schedules, local people have reduced the risks associated with losing an entire plantation during an extreme weather event.

Adapting to climate change not only requires individuals acting but also adjustments by wider stakeholders including governments, civil society organisations and public and private institutions through collective action (Adger and Tompkins, 2004). Hence, we need to have appropriate and effective adaptation strategies to involve stakeholders with clear roles and responsibilities. Climate change concerns and mechanism should be integrated into existing or planned policies and institutions at local, provincial, national and multilateral organisations and donor agencies.

Effective institutional arrangements are a requirement for adaptation planning and implementation. Hence, we should focus on engaging wider and appropriate institutional mechanisms from all levels on planning, designing, implementation and monitoring which ensure transparent and sustained outputs.

To improve institutional arrangements, we need to identify the key institutions and departments and their roles and responsibilities. The mechanism should facilitate an environment that encourages and supports the exchange of knowledge at all stages of the adaptation process.

Module 4: Monitoring, Reporting and Communicating Adaptation Work

Module Overview

This Module takes participants through different approaches to participatory planning and stakeholder engagement, monitoring techniques, indicators to be used in monitoring, data collection methods, documentation techniques, and results sharing strategies.

The Module has two sessions: i) participatory planning and stakeholder engagement, ii) monitoring techniques and indicators, and iii) data collection, documentation and wider sharing.

The Module has the following objectives:

- Improve skills in carrying out participatory planning and stakeholder engagement.
- Introduce monitoring techniques and indicators that can be used in monitoring activities.
- Orientation to data collection, knowledge documentation and results sharing tools, techniques and methods.

Learning Outcomes

After the session, participants will:

- Have the skills needed to carry out participatory planning and stakeholder engagement.
- Be familiar with different monitoring techniques and indicators that can be used in monitoring activities.
- Acquire the skills and techniques needed for data collection, knowledge documentation, and results sharing.

Session I: Monitoring & Evaluation of CCA Interventions in Agriculture

Time: 90 minutes

Methods: PowerPoint presentation, question and answer, discussion, quizzes

Materials: Training materials, LCD projector, laptop, flipcharts, markers

Objectives: Understand basic concepts of monitoring and evaluation, methods to identify key stakeholders and assess their interests and discover ways to engage them in implementation of climate change adaptation activities.

Tips to Facilitator

- Begin with a question: what do you distinguish monitoring and evaluation? You can either use a buzz group discussion or pair-group discussion
- Give several examples of M&E so that participants from different background can relate one or more of them with their own work.
- Run a quick exercise. You may ask all participants to list 5-10 indicators of climate change adaptation and post them on a wall so that one can read others during the breaks or a gallery walk. Gallery walk can be included in one session or during any break.

What is Monitoring and Evaluation?

The aims of monitoring and evaluation are similar—to provide information that can help inform decisions, improve performance and achieve planned results. The distinction is that evaluations are done independently to provide managers and staff with an objective assessment of whether or not they are on track. Both processes are rigorous in their procedures, design and methodology, and generally involve extensive analysis.

- Monitor and evaluate progress to verify whether adaptation actions are helping achieve the adaptation objectives and targets or are creating negative impacts.
- Periodically review the basic assumptions over time of information and knowledge about vulnerability and risk, vision and guiding principles, objectives and targets, and results of previous measures of actions.
- Regularly update climate change adaptation plans and actions in light of the information collected during the previous steps.

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 6

- What is Monitoring and Evaluation?
- Table 16. Basic differences between monitoring and evaluation.

Additional Materials

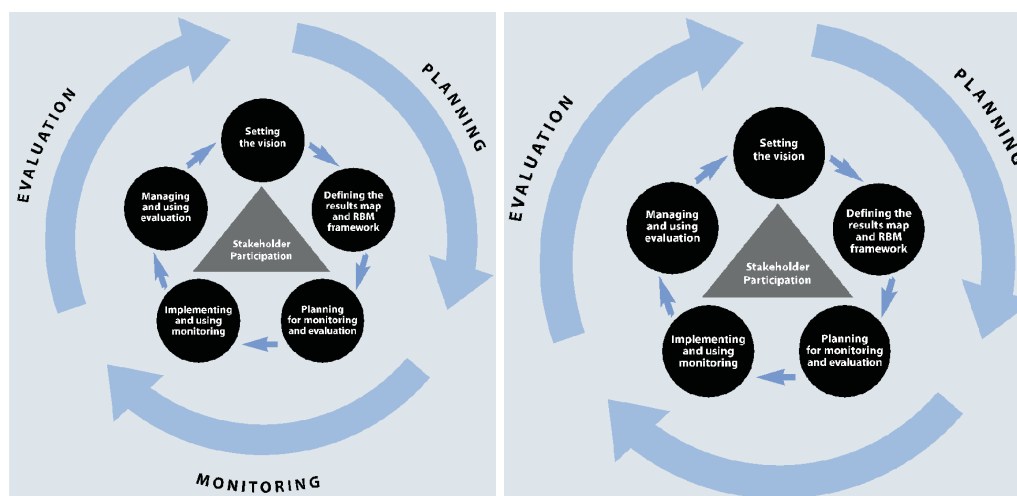


Figure M4-1. The M&E life cycle. UNDP 2009.

Why Monitoring & Evaluation?

See the following sections, figures and tables in the Handbook.

Chapter 6

- Why Monitoring and Evaluation?
- Table 17. Purposes of monitoring activity.

Basic Components of M&E

M&E is used extensively by international and national development agencies to assess progress and effectiveness. While there are no universally set definitions for M&E terms and concepts, typically there are four components.

See the following sections, figures and tables in the Handbook for lecture and presentation materials and participant reading material.

Chapter 6

- Components of Monitoring
- Components of Evaluation
- Figure 41. Basic Components of M&E
- Table 18

Framework for Monitoring and Evaluation

Monitoring tracks the use of inputs, activities, outputs and outcomes. A framework represents the underlying logic that explains how the development objective of a project is to be achieved. This is achieved by translating the results chain of an intervention into indicators that measure the degree to which inputs are being transformed into specific activities and outputs, and how much a target population is using those outputs as the anticipated outcomes of the project (OPSPQ, 2013). This is depicted in Figure 42 in the Handbook, which shows the chain of inputs, outputs, outcomes and impacts with the planning cycle.

See the following sections, figures and tables in the Handbook.

Chapter 6

- o Figure 42. Framework for M&E.

Additional Materials

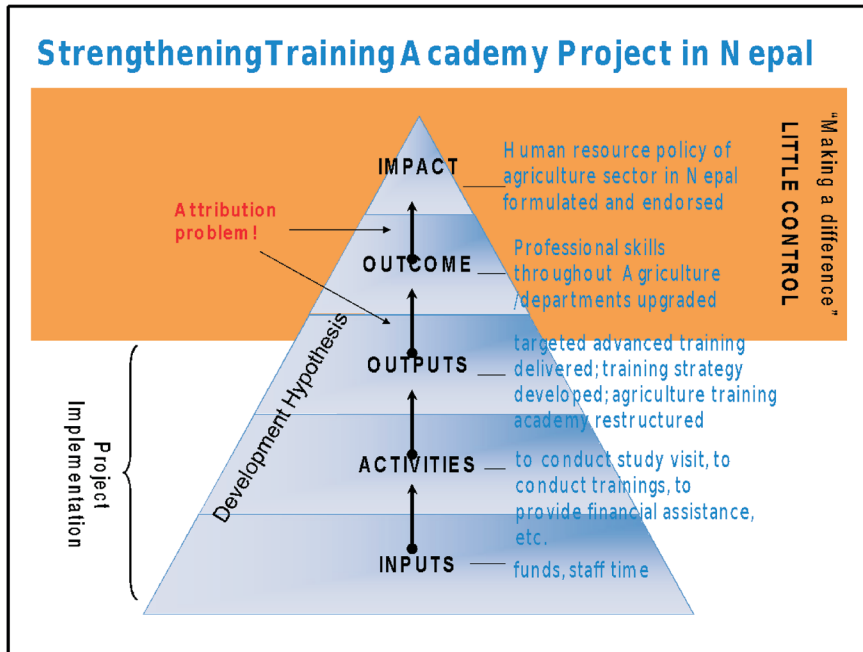


Figure M4-2 Framework for M&E. Example 2. Source: Adapted from OPSPQ, 2013.

Bours et al. (2014) derived adaptation M&E approaches based on the work of several organizations (Figures M3-10, 11, 12 and 13).

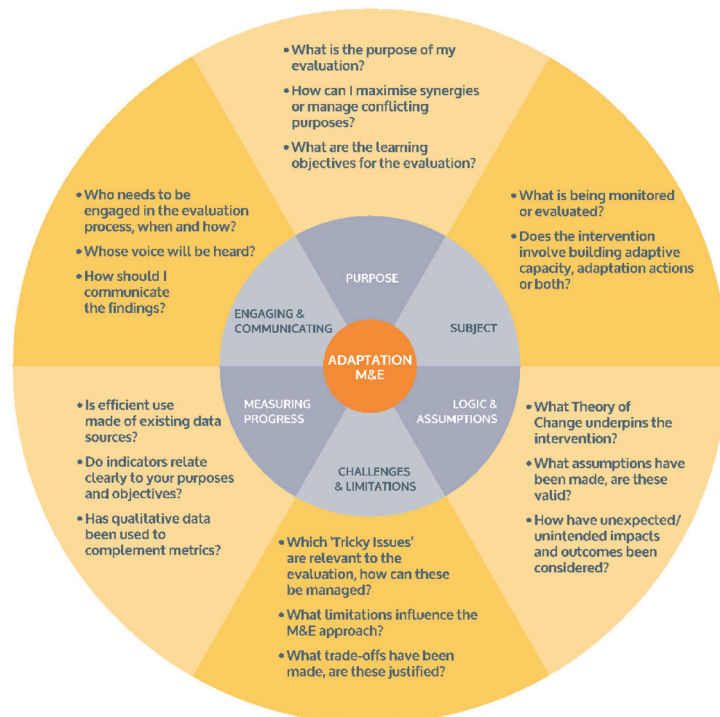


Figure M4-3. Adapt Nepal M&E Toolkit. Source: Bours et al. 2014. Adapted from Pringle et al., 2012.

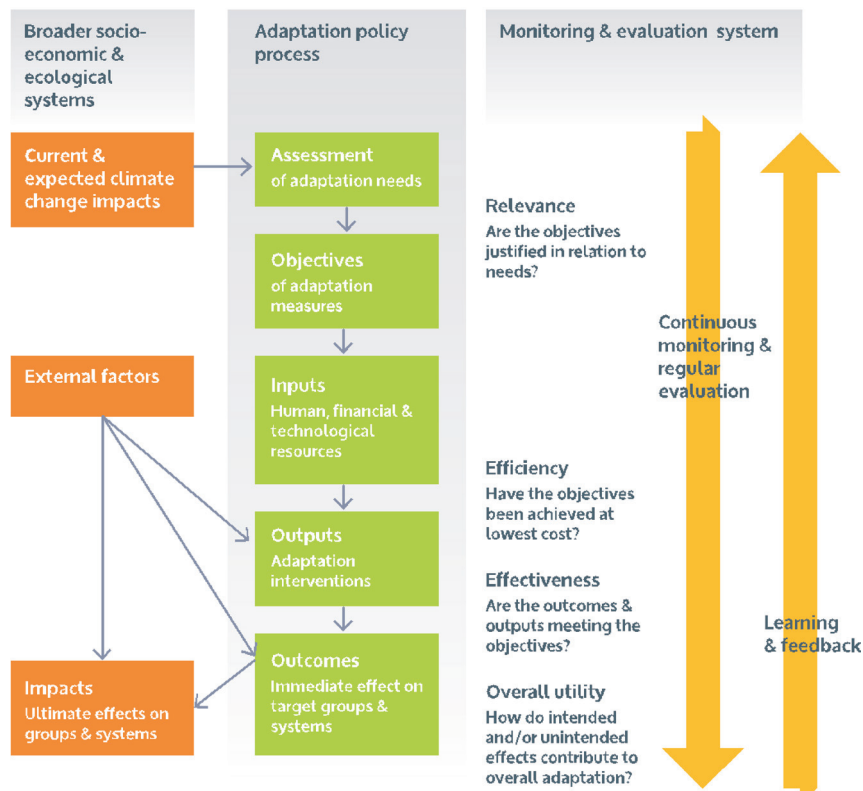


Figure M4-4. Climate change adaptation M&E framework. Source: Bours et al. 2014. Derived from UNFCCC, 2010.

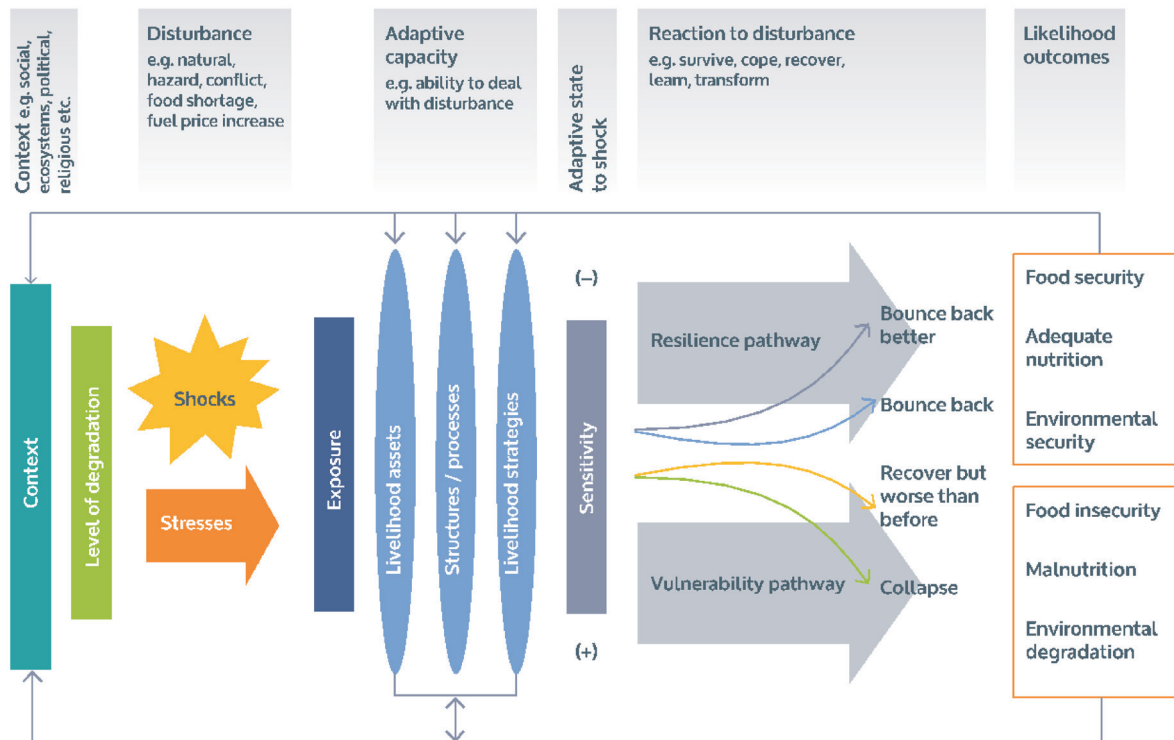


Figure M4-5. Technical Assistance to Non-Governmental Organisations (TANGO) approach to livelihoods resilience measurement and evaluation. Source: Bours et al., 2014. Derived from Frankenberger and Nelson, 2013.

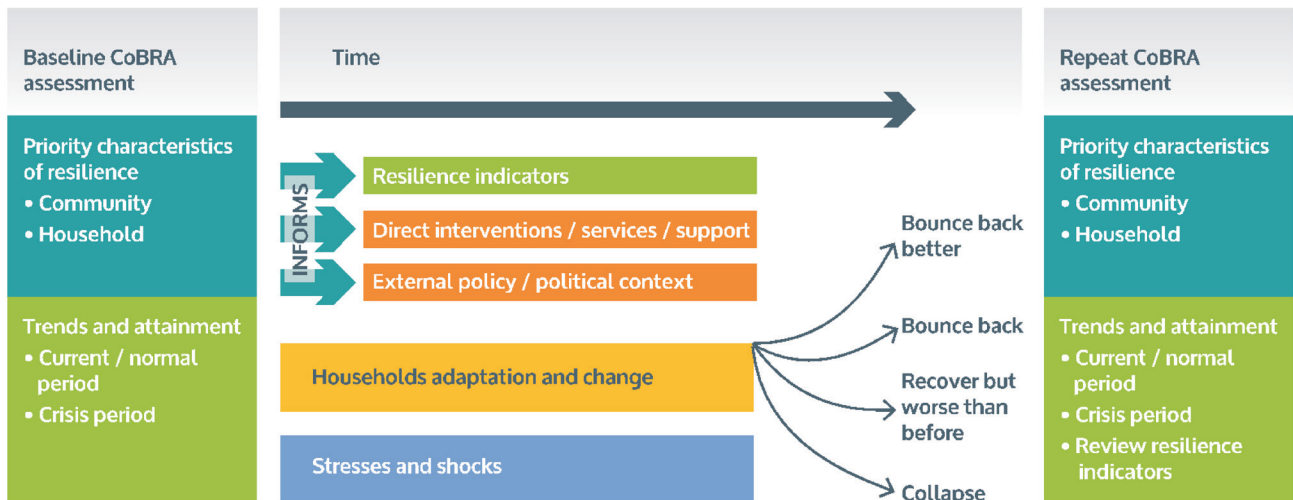


Figure M4-6. Community-based resilience assessment (CoBRA) conceptual framework and methodology. Source: Bours et al., 2014. Adapted from UNDP, 2013.

Programme and Project Monitoring and Evaluation

M&E should be continuous during the life of a programme or project. The findings, suggestions, and recommendations obtained from M&E can be used to make the changes needed to keep the programme or project on track.

See the following sections, figures and tables in the Handbook.

Chapter 6

- o Figure 44. Monitoring and evaluation process during programme or project period.

Components or Framework for Monitoring

The main objective of monitoring is to get information on the project to make decisions and timely corrections. Monitoring can be done by visiting the field or by using other sources and means of communication.

- Monitoring delivery of inputs as per schedule (financial, technical or other human resources, norms and guidelines, explicit rights and responsibilities, technology, physical goods and other inputs).
- Monitoring processes or activities started, in progress or completed activities as per schedule.
- Monitoring of expected outputs as per schedule (both quantity and quality).

Types of monitoring conducted at different stages of programme and project implementation are illustrated in Figure M3-15 and further elaborated in Table M3-4.

Table M4-2. Types of monitoring with their objectives. Source: NPC, 2013.

Types of monitoring	Objectives
Continuous	To track performance against predetermined input, activity, process and output indicators during the formative phase of a programme or project.
Sustainability	To ensure necessary resources and provisions needed for sustainability throughout a programme lifecycle. It is conducted after completing the formative phase of a programme or project.

Impact evaluation includes mainly relevance, efficiency, effectiveness, sustainability and outcome and impacts of the project or programme (Table M3-5). This is normally done by hiring independent experts as an evaluation team or subject matter specialists to validate the project achievements or failures against goals and objectives.

Table M4-1. Components of evaluation.

Components	Brief description
Relevance	The extent to which the aid activity is suited to the priorities and policies of the target group, recipient and donor.
Effectiveness	The extent to which an aid activity attains its objectives.
Efficiency	Measures the outputs (qualitative and quantitative) in relation to the inputs. Signifies that the funding uses the least costly resources possible to achieve the desired results.
Outcomes and impacts	This involves the main negative or positive impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators.
Sustainability	Measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn. Projects need to be environmentally and financially sustainable.

Table M4-3. Components of evaluation.

Results	Indicators	Baseline	Target	Means of Verification	Risk & Assumptions
Impact statement (<i>Ultimate benefits for target population</i>)	Measure of progress against impact				Assumptions from one outcome to impact. Risks that impact will not be achieved.
Outcome statement (<i>Short-to medium-term change in development situation</i>)	Measure of progress against outcome				Assumptions made from outputs to outcome. Risks that outcome will not be achieved.
Outputs (<i>Products and services-tangible and intangible-delivered or provided</i>)	Measure of progress against output				Assumptions made from activities to outputs. Risks that outputs may not be produced.
Activities (<i>Tasks undertaken in order to produce research outputs</i>)	Milestones or key targets for production of outputs				Preconditions for implementation of activities.

Types of Evaluation

There are many types of evaluation and methods that can be customised according to what is being evaluated and the purpose of the evaluation. This section presents the different types of evaluation that can be conducted over a program's life cycle and when they should be used (Table M3-7, M3-8, M3-9).

See the following sections, figures and tables in the Handbook.

Chapter 6

- Table 19. Types of evaluation.

Table M4-4. Types of evaluation at different times in the project cycle.

Type of evaluation	Objectives
Ex-ante	<ul style="list-style-type: none"> ● To determine the needs and assurances of programme/project continuity. ● To define indicators and clearly articulate the details of a programme/ project.
Midterm	<ul style="list-style-type: none"> ● To review progress of programme/project. ● To revisit and improve predetermined action plan and make necessary changes to operational modalities.
Final or terminal	<ul style="list-style-type: none"> ● To conduct a summative evaluation since they are undertaken towards the end of the implementation phase of projects or programmes.
Ex-post	<ul style="list-style-type: none"> ● To study how well the initiative served the purpose of a summative evaluation since they are undertaken towards the end of the implementation phase of projects or programmes.

Evaluations can be performed by procuring the specialized services of external experts or by forming teams of experts within the organization or by constituting a joint team of external experts and organizational staff.

See the following sections, figures and tables in the Handbook.

Chapter 6

- Table 20. Methods of Evaluation.

Indicators

An indicator is a measurable variable that helps assess the situation and track change over time. Adaptation indicators are essential to:

- Monitor progress towards implementing adaptation policies, strategies and actions.
- Target, justify and monitor funding for adaptation programmes.
- Communicate adaptation priorities to policy-makers and stakeholders.
- Compare adaptation achievements across sectors and regions.
- Provide inputs for international climate change related processes and mechanisms.

See the following sections, figures and tables in the Handbook.

Chapter 6

- Indicators
- Table 21. Indicators for hazards
- Table 22. Indicators for exposure
- Table 23. Indicators for sensitivity
- Table 24. Indicators for adaptive capacity

Participatory Planning and Stakeholder Engagement

Stakeholders are individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion.

Different participatory approaches have been developed over the years with the main objective of ensuring public and community participation in resource planning and use. Participation is defined as “a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them” (Luyet et al 2012). There is greater assurance that decisions are acceptable to stakeholders by adopting a participatory approach in developing action plans for implementing CCA options.

See the following sections, figures and tables in the Handbook.

Chapter 6

- Participatory Approach to Planning, Monitoring and Evaluation

Different stakeholders have different interests and viewpoints. There is a need for stakeholder analysis to assess the interests and importance of each stakeholder and discover how these stakeholders can help achieve the objectives. Stakeholder analysis is a technique that can help project team members understand the variety of stakeholders that have an interest in the project, and the individual nuances that can affect project risk. To do this we use a 4-quadrant analysis which will identify stakeholder positions and weigh their potential influence and assess the strength of their commitment.

Stakeholder Analysis for Participatory Planning

To carry out stakeholder analysis:

See the following sections, figures and tables in the Handbook.

Chapter 6

- Section: Approaches for Stakeholder Analysis for Participatory Planning
- Example of a stakeholder analysis context diagram
- Figure 46. Importance-Influence classification
- Figure 47. Stakeholder participation matrix

Approaches to Developing Participatory Monitoring and Evaluation Systems

See the following sections, figures and tables in the Handbook.

Chapter 6

- Approaches for Stakeholder Analysis for Participatory Planning
- Figure 46. Example of a stakeholder analysis context diagram
- Figure 47. Importance-Influence classification
- Figure 48. Stakeholder participation matrix

A participatory monitoring and evaluation system is a new way of assessing and learning. Two approaches to developing participatory monitoring and evaluation systems are shown below:

Community-driven	At institutional level
<p>This approach builds on the concepts and ideas developed by the Institute of Development Studies at the University of Sussex (Estrella et al., 2000; Guijt & Gaventa, 1998), the PIM concept developed by Germann et al. (1996), and more recently by Probst (2002). Community members identify their own objectives and initiate activities to achieve these objectives.</p> <p>The community develops their indicators for measuring progress towards achievement of the objectives; indicators to assess change; community indicators are based on local experiences, perceptions and knowledge.</p>	<p>Stakeholders involved in research and development projects including communities define project objectives and activities in deciding what should be monitored and evaluated.</p> <p>Contribute to the development of indicators to measure the achievement of objectives and the successful completion of activities. Data and information collected are shared systematically by the stakeholders leading to learning and adjustment of activities and approaches and to the documentation of best practices.</p> <p>Communities or local stakeholders can be involved in various ways including during the initial implementation stage, data analysis, use and sharing of information.</p>

Session II: Data Collection, Documentation and Wider Sharing of Adaptation Outcomes

Time:	90 minutes
Methods:	PowerPoint presentation, question and answer, discussion, quizzes
Materials:	Training materials, LCD projector, laptop, flipcharts, markers
Objectives:	To improve skills on data collection and documentation of good practices on climate change adaptation and sharing results for aiding adoption of good practices and successful adaptation options for creating impact at scale.

Data Collection and Documentation

Data collection and management processes include data collection and storage, analysis, documentation and management. Data collection is the process of gathering and measuring information on variables of interest in an established systematic way that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.¹ Well-chosen and well implemented methods for data collection and analysis are essential for all types of research, projects and programmes.

Systematized data collection and documentation of policies and procedures are essential because they:

- Help provide information about the intended and unintended long-term effects of programmes or policies.
- Provide a basis for monitoring, implementation and evaluation.
- Ensure transparency, accountability and follow-up of research where necessary.
- Draw clear lessons from programmes and facilitate scaling up or replication.
- Help make informed decisions for further analysis, study, and research.

Data Collection Methods

Data collection is a process of collecting information from all relevant sources to find answers to a research problem, test hypotheses and evaluate outcomes. Data collection methods can be divided into primary and secondary methods (Table M3-13).

See the following sections, figures and tables in the Handbook.

Chapter 6

- Data Collection and Documentation Methods
- Table 25. Data collection methods
- Table 26. Possible data collection options

There are many methods for collecting data. Table 27 in the Handbook provides examples of possible existing and new data sources.

Documentation

Documentation constitutes an essential part of a quality assurance system. Clearly written procedures prevent errors resulting from spoken communication, and clear documentation permits tracing of activities performed. It is important to systematically document data so users can understand and interpret it correctly.

See the following sections, figures and tables in the Handbook.

Chapter 6

- Table 27. Types of documentation
- List: These points must be considered to maintain the quality of documentation

Processing, Analysing and Documenting Data

See the following sections, figures and tables in the Handbook.

Chapter 6

- Section: Processing, Analysis and Reporting
- Figure 48. Process of data management.

Data management includes developing effective processes for: consistently collecting and recording, storing securely, cleaning, transferring (e.g., between different types of software used for analysis), effectively presenting and making data accessible for verification and use by others. Data should be managed at every step to maintain the quality.

The people involved in data management and sharing include:

- Project director designing research
- Research staff collecting, processing and analysing data
- External contractors involved in data collection, data entry, processing or analysis
- Support staff managing and administering research and research funding
- Institutional IT service staff providing data storage and back-up services
- External data centres or web services archives that facilitate data sharing

Assuring Data Quality

Documentation constitutes an essential part of the quality assurance system. Data quality refers to the accuracy or worth of information collected. It is the ability of data to serve the purposes for which it was gathered. Clearly written procedures prevent errors resulting from spoken communication, and clear documentation permits tracing of activities performed. To maintain the assurance of data, various components of data quality are shown in Table 29 in the Handbook.

See the following sections, figures and tables in the Handbook.

Chapter 6

- Assuring Data Quality
- Table 29. Aspects of data quality
- Figure 51. Data quality management process

Data Sharing

Data are a valuable resource, usually requiring much time and money to produce. Many data have a significant value and sharing research or project data has the following benefits:

See the following sections, figures and tables in the Handbook.

Chapter 6

- Data sharing
- Ethical Issues in Documentation and Data Sharing
- Table 30. Ensuring ethical practices in communicating and reporting.

Module 5: Evaluation, Recap and Closing the Program

Module Overview

Evaluation of training is an important step of a thoughtful training. It helps identify strengths and weaknesses of the training so that future training activities can be improved. There are quantitative and qualitative evaluation techniques and one can choose the tools based on type of participants and nature of training.

The Module has one session devoted to one quantitative and one qualitative technique.

The Module has the following objectives:

- Improve skills in carrying out course evaluation including participants' reflections.
- Introduce tools to conduct course evaluation.

Learning Outcomes

After the session, participants will:

- Have the skills needed to carry out evaluation – prepare questionnaires, synthesize information and analyse data
- Learn how to document participants' reflection on the training

Session I: Evaluation of Training

Time:	90 minutes
Methods:	PowerPoint presentation, questioning, discussion, quizzes
Materials:	Handouts, projector, laptop, flipcharts, markers
Objectives:	To assess whether the training was useful to the participants, assess whether it led to significant attitudinal changes among participants, analyse the training methodology and plan future training programmes.
Tips to Facilitator	<ul style="list-style-type: none"> • This is very important if you have a plan to conduct similar training in the future. Carefully collect the feedback and feed that into the future course design, session planning and preparing the slides. • You can use an evaluation wheel or just distribute handouts for the participants to fill out. Examples are given below. • It is important to measure the current level of understandings compared to the pre-training assessment. This gives to what extent the training has improved the knowledge and skills of participants. • Also allow participants to give their reflections and properly note them down for future use. • It is important to include training materials, facilitator's skill, balance between theory and practice, time planning, relevance of topics, venue, food, accommodation, and other conditions as appropriate.

A pre- and post-training evaluation is important to determine the level of change brought about in terms of understanding and knowledge. Personal judgements before and after the training help participants rate their change in knowledge and understanding about the subject matter. Sample forms are shown below. Trainers, facilitators and donors may have additional or alternative formats they would like you to use.

Post-training Assessment

Please tick the box based on your level of understanding and engagement:

- 1: Never heard about the subject.
- 2: Heard about it but do not know the subject.
- 3: Heard about it but have little knowledge.
- 4: I have better knowledge and can use it in my work.

Table M5-1. Training evaluation format.

Subject matter (1 is low, 4 is high)	1	2	3	4
Your knowledge about concepts of weather, climate, climate change and global warming				
Causes of climate change and impacts on agriculture				
Vulnerability to climate change				
Vulnerability tools, techniques and methods				
Government initiatives in climate change adaptation				
Climate change adaptations				
Climate change adaptation techniques				
Participatory planning and stakeholder engagement				
Climate change monitoring techniques				
NAP and NAP-Agriculture project				

Feedback and Reflection

Self-reflection is a critical component of any feedback that aims to encourage learning. By asking participants to reflect critically on their own performance, they will better realize that they are ultimately responsible for their own learning. Several methods are used to collect participant feedback and reflections. Individual and face-to-face feedback and group feedback and reflections are ways of documenting feedback.

It is important that participants assess the training programme, both in writing and verbally. A written assessment makes it easier for participants to be critical, provided their response remains anonymous. Participants should be asked to assess both the content and methodology.

The feedback form should have enough blank space so participants can write questions, suggestions or comments. After collecting the completed feedback forms, invite participants to verbally share their suggestions for improvement. Listen carefully to negative feedback and check with participants how the training can be improved. When participants indicate that some subjects are more useful than others, plan for more training on such subjects. When participants find it difficult to understand some topics, plan for refresher training courses. Conclude the training programme with acknowledgements to all those who helped make it successful and offering your best wishes to the participants for success in their ventures.

Handout 1: Training feedback form (Note: This is a sample form. You can rewrite or revise the topics to suit your training programme).

1. What are the three most important things you learnt during this training?

2. Please indicate the training subjects you found most useful for your group. Do you think it is necessary for group members to learn about this?

3. How are you going to use the learning in your daily life and your cooperative group after returning to your village?

4. Did you enjoy the learning methodology? Please comment on the use of:

Group exercises

Role plays

Case study discussions

Market visits

Lectures

5. Do you have any other suggestions to make this training more useful?

